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Imperial Industrial Standardisation.

AMONGST the many valuable products of the recent Imperial Conference must be included the admirable report of the General Economic Sub-Committee on the subject of industrial standardisation, of which an abstract was given in our issue of November 26th. This is a movement in which Britain has led the world, and other industrial countries have eagerly studied the methods evolved by our British Engineering Standards Association, which has done so much during the past quarter of a century to cheapen the cost of production in many industries.

Like other altruistic organisations in this country, the B.E.S.A. has had to depend mainly on voluntary contributions, and there is no doubt that its activities have been greatly hampered by the lack of funds; the value of its work is constantly gaining in public esteem, and its long uphill struggle will certainly end in the attainment of an assured position with a corresponding revenue—but how much more could have been effected if some of the funds so freely expended by our Governments on far less worthy objects had been devoted to its support!

No mention of the B.E.S.A. and its work can be complete without a word of appreciation for the efforts of the army of members of panels, committees, sub-committees, &c., whose entirely voluntary and gratuitous expenditure of valuable time in the interests of the nation deserves the most grateful recognition; nor can we omit a reference to the efficiency and sagacity of the permanent staff, headed by the general secretary, Mr. C. D. Le Maistre, whose personal qualities have earned for him a world-wide reputation.

We now look forward to the fulfilment of the recommendations of the Sub-Committee—that the several Governments of the Empire should promote the further development of standardisation, arrange for the exchange of information, and co-operate in the establishment of common standards. Whilst the organisation of Engineering Standards Associations in various parts of the Empire (five exist at present) is desirable and useful, their work will be largely stultified if they do not agree with one another, and therefore co-operation and the exchange of information are essential to success; the remaining recommendation—that the Governments

should promote further standardisation—involves not only the use of accepted standards by Government buying departments, but also the help of Government research establishments and the support of the respective Treasuries. We do not advocate lavish expenditure by any Government, but on the other hand we deprecate short-sighted economies, and to withhold financial support from standardisation and research is not economy, but purblind folly. Investment in these twin undertakings will undoubtedly prove at least as profitable to the nation as was the purchase of shares in the Suez Canal; let us hope, therefore, that our statesmen, some of whom have shown a sincere appreciation of the commercial value of scientific method, will realise that by a comparatively moderate expenditure they can enormously increase the productiveness of the British Engineering Standards Association and its congeners overseas, and that the resulting economies will not only repay the outlay many times over, but will also strengthen the hands of British manufacturers in competition with their foreign rivals by reducing the cost of production, which is the key-note of revival in our export trade and the best mode of safeguarding our internal markets.

The report of the Research Sub-Committee was of equal importance, recognising to the full the enormous benefits to be derived from the encouragement of research throughout an Empire which possesses unrivalled natural resources of infinite variety. Here, again, the necessity of full co-operation and the exchange of information was emphasised; the need for a settled policy and for raising the status and prospects of men engaged in research work, so as to encourage our schools and universities to provide training facilities and to induce students to undergo training, was also clearly stated. As history has shown—most markedly during the war—we have unlimited stores of native talent for research, capable of rapid development, and if good prospects are held out to research workers, including the certainty of continuity of employment, we have no doubt that the demand will quickly be met and the new research bureaux that are foreshadowed will soon be adequately staffed.

Portraits for the I.E.E.

ALTHOUGH the Institution of Electrical Engineers has numbered in its membership many distinguished scientists and engineers, it must be confessed that, apart from a collection of framed photographs of its past presidents, it has hitherto possessed no series of paintings such as adorns the walls of the theatre of the Institution of Civil Engineers. However, a start has now been made to remedy this deficiency, and most appropriately the portraits of Faraday and Kelvin have been chosen as the first to be installed. The latter was provided at the cost of the Institution; the former, painted by Mr. George Harcourt, R.A., was presented on Thursday last week by Mr. Sidney Evershed to the members of the Institution of which, as he said, he was so proud, and we gathered that the new departure was due to his initiative.

The portraits, which have been hung in the theatre of the Institution, are admirable in themselves and splendid indeed in theme; what member of the Institution can look upon them without a glow of pride—in Faraday as the father of electrical engineering, and in Kelvin as the greatest scientific worker since Newton? And in presenting his generous gift to the Institution, Mr. Evershed delivered a brief but eloquent oration on the personalities of these two great men, which held his audience spellbound, and was worthy of the best traditions of the Institution. He skilfully portrayed the contrast between Faraday, the physicist, and Kelvin, the mathematician, who were poles apart in their intellectual processes, but were twin brothers in their modesty. Not only for the portrait, but also for his admirable little address, the thanks of the Institution should be given to Mr. Evershed.

Tapping E.h.p. Mains in the Country.

WHILST the Electricity (Supply) Bill was passing through the Committee stage in the House of Lords last week, Lord Montagu of Beaulieu, innocently accepting at their face value the statements of Government representatives that the Bill would bring electricity into the rural areas through which the mains passed, proposed as an amendment to Clause 4 that transforming stations should be provided "on the main transmission lines at intervals of not more than ten miles apart in order to make a supply of electricity available" for agricultural and other rural industries. Unless this was done, he said, the cables would be quite useless for the countryside, and he pointed out that a great point had been made by the Government of the benefit that country dwellers would derive from the scheme.

We will not suggest that transforming stations at ten-mile intervals on a 150,000-V line would necessarily form an unbroken chain of plant and switchgear from one selected station to the next; obviously, the substations might be laid out crosswise, or up-ended. But the thought of such a series of extra-high-pressure step-down stations is sufficiently startling, and we can imagine how it would stimulate the salivary glands of a switchgear manufacturer. As we have previously pointed out, it will not be commercially feasible to tap the lines at closer intervals than 40 or 50 miles, except where densely-populated industrial areas closely adjoin; if the rural areas are to be fed from the transmission lines, that must be done by secondary mains radiating from the few tapping points, and those mains will be provided by the local electricity supply authorities and not by the Central Board, which has no interest in distribution. Our sympathies are with Lord Montagu, for we also are unable to see how the farmers will derive any benefit from the operation of the Bill when it becomes an Act; and his hope that roadside charging stations would be provided for electric vehicles at ten-mile intervals was similarly ill-fated—as Viscount Peel informed him, the transformation to suit battery requirements "would be a very expensive task indeed, and could quite well be done by the authorised distributors whose business it is," and who no doubt will thank the speaker for the suggestion.

The fact is that the rural areas will not be one iota better off under the Bill than they are now; anything that is done for them will, as heretofore, be done by the local electricity supply undertakings, for the Bill does nothing at all for them.

The Anglo-German Conference.

PROBABLY the main point issuing from last week's Anglo-German industrial conference is a negative one: that the question of international cartels or combines was not discussed. Several important questions were dealt with on broad lines, and in at least one case something definite was decided upon, namely, both parties agreed to approach their respective Governments with a view to "the avoidance of losses and friction occasioned by the double taxation of the nationals of one country by the revenue authorities of the other."

It was decided that the discussion of tariffs was inadvisable and premature, but the delegates agreed that much preparatory work might well be considered. The two organisations were agreed that many State subsidies to industry were harmful, and it was decided that such grants should be scheduled with a view to reaching a common policy.

Tentative arrangements were reached regarding the interchange of power costs and other scientific or technical data relating to production. Other matters touched upon were export credits and trade fairs.

In the official summing-up it was emphasised that the discussions were almost entirely of an exploratory character with a view to ascertaining in what direction the Federations and the industries which they represent could best co-operate.

Short-Circuit Currents.

Calculations on a Large Interconnected Three-phase Distribution System.

By G. CLULEY, A.M.I.E.E.

SEVERAL articles have been written on the calculation of short-circuit current, but none, as far as the writer is aware, have really dealt with the problem as it is met with in practice on large interconnected distribution systems. It is a comparatively simple problem to determine the short-circuit kilo-volt-amperes in a network fed from one power station, but when a number of power stations are connected together and each is capable of feeding power into the system, the calculations are considerably more involved.

On simple systems it is the usual practice to calculate short-circuit capacities on the percentage impedance principle, that is, to determine the percentage impedance to the flow of current in the lines, transforming and generating plant, on the basis of the given generating-plant capacity. Where, however, several stations are feeding a system, and each station is of a different capacity, the only satisfactory method of determining the short-circuit kVA is by what the writer terms the relative-impedance method. This is one whereby the impedances of the various cables, or overhead lines and transformer and generator windings, are first calculated from the various capacities and per cent. impedance and impedance diagrams prepared from which the total impedance to the flow of current at any given point can be computed. In a system where various voltages are employed, it is necessary to base all impedance values on one particular voltage only, and the term "relative" is used to imply that all ohmic values of impedance are only relative to the one particular voltage on which the calculations are made. The actual short-circuit currents can be determined by dividing the short-circuit kVA by the actual voltage in the line or busbar.

The writer now proposes to deal in detail with the calculations involved in a given distribution system. Fig. 1 represents a system with overhead-transmission lines linking up various generating and distributing stations on 110 kV. It will be observed that there are three main generating stations, A, D, and E. B and C are distribution points only, whilst F and G are distribution points where synchronous condensers are employed for power-factor correction. The first details required are the impedances of the various lines and the relative impedances of the generating plant. In the case of F and G, the two synchronous condensers must be treated as generating plant, since at the moment of short circuit they will act as generators and supply power into the network. To find the impedances of the various lines we must know the particulars of the lines, and as a basis for calculation we will assume the line data to be as follows:—

Lines AB and BC; section, 0.232 sq. in. copper, spacings, 189 in. and 284 in.: line CD; section, 0.186 sq. in. copper, spacings, 283 in. and 378 in.: line CE; section, 0.147 sq. in. copper, spacings, 189 in. and 284 in.: line EF; section, 0.1085 sq. in. aluminium, spacings, 189 in. and 189 in.: line AG; section, 0.1085 sq. in. aluminium, spacings, 189 in. and 189 in. The spacings of the lines are represented by fig. 1a.

With given line data we can calculate the various impedances. These have two main components, namely, resistance and reactance, and since the currents of these two components are 90 deg. apart, their values must be calculated separately and added vectorially when the total resistance and reactance of the network has been determined.

The resistance calculations are a simple proposition since, from standard tables, we can find the resistance per mile for a given section of conductor. The reactance, however, is dependent upon the diameter and spacing of conductor and needs calculation. A well-known formula for the calculation of reactance of overhead line is as follows:—$L = (.000421 \log_{10} d/r + .0000457)$; where L = henries per 1,000 yards, d = distance between conductors triangularly spaced, and r = radius of conductors: reactance $= 2 \pi f L$.

It will be noted that the lines under consideration are not equally spaced in triangular formation, and consequently the distance d must be obtained from the formula: $d = \sqrt[3]{d_1 d_2 d_3}$. It has been previously mentioned that the line impedance has two main components, *i.e.*, resistance and reactance. There is also another component, namely, capacity, but it is not proposed to take this into account, since on an overhead line with large spacing the capacity is comparatively small and the quantity is negligible when considering short-circuit calculations. Even with cable networks it is not essential to take into account capacity.

Since the line data and the method of determining the reactance have been given previously, the line calculations may be proceeded with as follows:—Tables show the resistance of .232 sq. in. copper as 0.183 ohms per mile, therefore the total resistance R of line AB is $0.183 \times 22 = 4$ ohms (single conductor). $d = \sqrt[3]{d_1 d_2 d_3} = \sqrt[3]{189 \times 284 \times (189 + 284)} = 294$ in. r = radius of .232 sq. in. conductor.

If the conductor were a single solid wire we would obtain the radius from the formula: area $= \pi r^2$, but since the conductor will be stranded cable, radius r must be obtained from standard tables, and assuming

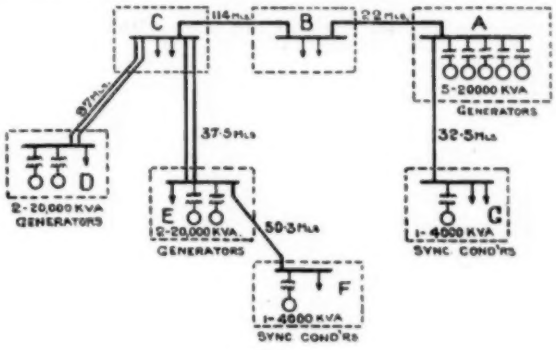


Fig. 1.

a 37-strand cable of .232 square inches, the radius would be .32 in., and $d/r = 294/.32 = 920$; then $L = .000421 \times \log_{10} 920 + .0000457 = .0012957$, and the reactance per 1,000 yards $= 2\pi f .0012957$, and with a periodicity of $50 = 3.14 \times 100 \times .0012957 = 3.14 \times .12957 = .406$. The reactance X for line AB would therefore be $.406 \times 22 \times 1{,}760/1{,}000 = 15.75$ ohms.

Similarly, the resistance for line BC would be $0.183 \times 114 = 20.8$ ohms, and the reactance X $.406 \times 114 \times 1{,}760/1{,}000 = 81.6$ ohms.

For line CD the resistance of 0.186-sq. in. copper being 0.228 ohms per mile, the total resistance R for the double line $= .228 \times 97/2 = 11.1$ ohms.

The section and spacings for this line are somewhat different to line AB, and consequently we obtain a different value for d/r. For d we have

$$\sqrt{283 \times 378 \times (283 + 378)} = 414 \text{ in.},$$

and for r, the radius of 0.186 sq. in. copper, we obtain from standard stranded cable table 0.285.

Then $d/r = 414/0.285 = 1{,}450$, $L = .000421 \times \log_{10} 1{,}450 + .0000457 = .0013757$, and reactance per 1,000 yards $= 2 \pi f .0013757 = 433$ ohms.

The reactance X for 97 miles of double line would be $.433 \times 97 \times 1{,}760/1{,}000 \times 2 = 37$ ohms.

For line CE, the resistance of 0.147-sq. in. copper being 0.29 ohms per mile, the total resistance is $0.29 \times 37.5/2 = 5.45$ ohms.

Here $d = \sqrt[3]{189 \times 284 \times (189 + 284)} = 294$ in., and r (from standard stranded cable table) $= 0.25$ in.; then $d/r = 294/.25 = 1,175$.

L $= .000421 \times \log_{10} 1,175 + .0000457 = .0013387$; the reactance per 1,000 yards $= 2\ \pi\ f\ .0013387 = .42$, and for the 37.5 miles of double line, $.42 \times 37.5 \times 1,760/2 = 13.9$ ohms.

In the case of line EF we are dealing with aluminium conductors of 0.1085 sq. in. section, and allowance must be made for the relative conductivity of copper and aluminium wire. Assuming that aluminium has a conductivity of 60 per cent. of that of copper, we can take an equivalent copper section of $.1085 \times .6 = .0652$ sq. in., and we get (from a table) a resistance of 0.64 ohms per mile, and for a single line, 50.3 miles long, a total resistance R of $0.64 \times 50.3 = 32.2$ ohms.

For d/r, $d = \sqrt[3]{189 \times 189 \times (189 + 189)} = 240$ in., and r, from the standard table, 0.216 in.; then $d/r = 240/.216 = 1,110$.

L $= .000421 \times \log_{10} 1,110 + .0000457 = .0013307$, and the reactance per 1,000 yards $= 2\ \pi\ f\ .0013307 = .418$ ohms; and for 50.3 miles of single line, $0.418 \times 50.3 \times 1,760/1,000 = 37$ ohms.

The conductivity of line AG is similar to line EF, and with a resistance of 0.64 ohms per mile, the total resistance R for 32.5 miles would be $.64 \times 32.5 = 20.8$ ohms.

With a calculated reactance of 0.418 ohms per 1,000 yards, and for a single line of 32.5 miles long, we get a total reactance X $= .418 \times 32.5 \times 1,760/1,000 = 23.8$ ohms.

We have now obtained the ohmic values for resistance and reactance drop throughout the whole of the network, and it remains to obtain the relative impedance for the generating and transforming plant. As previously mentioned, in working out an impedance diagram, all impedances must be calculated on a predetermined voltage, and since all line calculations are actual, it is necessary to determine the plant impedances relative to 110 kV, as they are to be added to the line impedances. The generators and transformers can be considered to have negligible resistance drop, and assuming that all generators have 10 per cent. reactance and transformers 8 per cent. at their rated capacities, we may calculate their relative reactances as follows:—

In station A the five 24,000-kVA generators and transformers have a total initial short-circuit kVA of $5 \times 24,000 \times 100/(10+8) = 666,000$ kVA. The initial short-circuit current, based on 110 kV, therefore $= 666,000,000/110,000 \times \sqrt{3} = 3,500$ amperes, and the relative reactance value per phase $= 110,000/3,500 \times \sqrt{3} = 18.15$ ohms.

In each of stations D and E, having two 20,000-kVA generators and step-up transformers, the total initial short-circuit kVA is $2 \times 20,000 \times 100/(10+8) = 222,000$ kVA. The initial short-circuit current is then $222,000,000/110,000 \times \sqrt{3} = 1,170$ amperes, and the relative reactance per phase $= 110,000/1,170 \times \sqrt{3} = 54.3$ ohms.

In the sub-stations F and G, each 4,000-kVA synchronous condenser, with step-up transformer, has an initial short-circuit kVA of $4,000 \times 100/(10+8) = 22,200$ kVA; the intial short-circuit current is then $22,200,000/110,000 \times \sqrt{3} = 117$ amperes, and the relative reactance per phase, $110,000/117 \times \sqrt{3} = 543$ ohms.

Having now determined the whole of the resistance and reactance to the flow of current relative to 110 kV, we may now prepare our impedance diagram to represent a short circuit at any particular point on the network.

Fig. 1a.

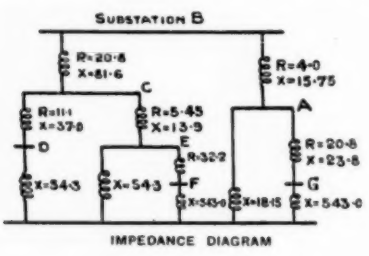


Fig. 2.

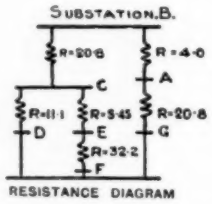


Fig. 3.

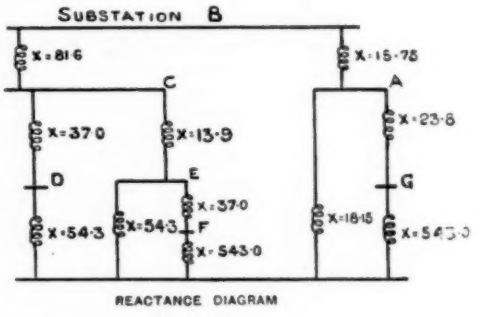


Fig. 4.

Fig. 2 shows an impedance diagram representing a short circuit on the 110-kV busbars at sub-station B. It will be observed that the resistance and reactance values are kept quite separate since, as stated previously, it is necessary to compute the total resistance and the total reactance independently and add the two quantities together vectorially in order to obtain the final impedance. Figs. 3 and 4 show the diagram, fig. 2, split up into the separate components of resistance and reactance respectively. All resistances and reactance values are calculated per single-phase line—that is, the relative impedance from the fault to the neutral point of the generating plant. The ultimate results will be on the assumption of a symmetrical 3-phase short circuit, which is the worst possible condition of fault. Referring to the diagrams, figs. 3 and 4, it will be noted that these consist of a number of series and parallel resistances and reactances, and in

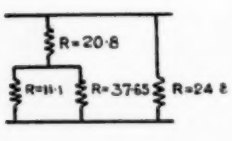


Fig. 5.

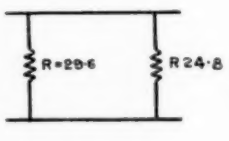


Fig. 6.

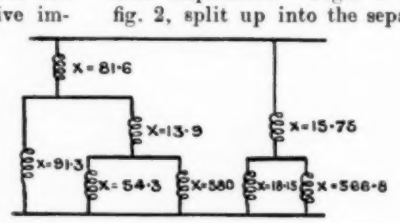


Fig. 7.

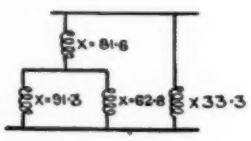


Fig. 8.

order to obtain the resultant values the diagrams must be reduced by the process of eliminating the various series and parallel paths separately. Fig. 3 can be simplified by adding together the resistances 5.45 and 32.2 and also 4 and 20.8, the simplified diagram being as fig. 5. We now proceed to find the resultant resistance of the values 11.1 and 37.65, this being—

$$11.1 \times 37.65/(11.1+37.65)=8.8,$$

and after adding together this value of 8.8 with the resistance 20.8, the resultant diagram is as shown in fig. 6. From this the total resistance in the network is equal to—

$$29.6 \times 24.8/(29.6+24.8)=13.5 \text{ ohms.}$$

Referring to the reactance diagram, fig. 4, this can be simplified by first adding together the values 37.0 and 54.3, 37.0 and 543.0, and 23.8 and 543.0, giving a resultant diagram as shown in fig. 7. Continue a stage further by finding the resultant of the parallel reactances 54.3, 580 and 18.15, 566.8, as follows:—

$$54.3 \times 580/(54.3+580)=48.9,$$
$$18.15 \times 566.8/(18.15+566.8)=17.55.$$

Adding together the values 48.9 to 13.9 and 17.55 to 15.75, the diagram as shown in fig. 8 is obtained. The resultant value for the reactances 91.3 and 62.8, shown in fig. 8, is as follows:—

$$91.3 \times 62.8/(91.3+62.8)=37.2.$$

Adding together the value 37.2 to 81.6, there are then only two parallel resistances to compute, giving the total reactance of the network equal to—

$118.8 \times 33.3/(118.8+33.3)=26$ ohms total relative reactance.

Having now obtained the total resistance and relative reactance to the flow of fault current on the sub-station B busbars, we can obain the total impedance by adding the values vectorially as follows:—

$\sqrt{26^2+13.5^2}=\sqrt{676+182.3}=\sqrt{858.3}=29.3$ ohms total relative impedance.

Bearing in mind that the impedance value obtained is relative to 110 kV, we can calculate the initial short-circuit current per phase as follows:—

Line volts/impedance $\times \sqrt{3}=2{,}154$ amperes, and the initial short-circuit kVA $= 2{,}165 \times \sqrt{3} \times 110{,}000 =$ 412,500 kVA.

The value of 412,500 kVA obtained above is the peak value of the short-circuit kVA, and in dealing with the rupturing capacity on oil-immersed circuit breaker it is necessary to determine the short-circuit kVA at the time the contacts of the circuit breaker begin to open. Assuming that for the average breaker the contacts separate in about 0.2 second after the occurrence of a fault, it is necessary to determine the value after this period of time. From short-circuit tests carried out in conjunction with modern alternators, oscillograph records show that the current drops to about 60 per cent. of its initial value after a period of 0.2 second, chiefly due to the demagnetising effect of the field from armature reaction. This is equivalent to a higher impedance in the alternator windings, and if the whole of the impedance is internal to the alternator, the kVA interrupted by the oil-immersed circuit breaker would be 0.6 times the initial short-circuit kVA. This value of 0.6, or 60 per cent., is generally termed the decrement factor.

(To be concluded.)

The Fire Hazard of Large Transformers.

The Relief of the Tank Fault Pressure.

By C. H. S. TUPHOLME.

POWER transformers have steadily increased in size until at the present time units containing upwards of 5,000 gallons of oil are not uncommon; and, as the oil is combustible, the question of fire hazard has been raised. Consideration of this subject suggests that the hazard with modern designs is "potential" rather than "actual." The following three conditions must exist before a fire can start:

1.—The temperature of the oil must be at, or above, its ignition point.

2.—Air must be present.

3.—There must be a source of ignition, such as an arc.

Under normal operating conditions the maximum oil temperature in a large modern transformer is generally below 80 deg. C., whereas the flash point of the oil used generally exceeds 150 deg. C. The amount of heat required to raise the temperature of the whole body of oil to a dangerous figure would obviously be very considerable, and it is unlikely that external causes will do so, especially in outdoor sub-stations. When installed indoors, large transformers are usually separated from other gear by fireproof walls or other protective devices, and it is unlikely that a fault in one part of a building would ignite the oil in another part. The heat required could not be produced by an overload, or by an internal fault, unless all the switches and protective gear failed to act, and the energy flow persisted for a long time.

In the past fires have probably started through the ignition of a mixture of oil vapour and air in the top of the tank. Such a mixture may be explosive. In modern transformers with conservators there is no air in the main tank, hence the second condition for fire does not exist; and, as the tank is completely oil-filled, there can be no corona discharge or spark due to electrostatic conditions, so that the third condition for fire is eliminated. The provision of complete oil filling has, however, introduced a new danger, namely, the possibility of tank rupture due to internal pressure caused by gas generated in the tank by a fault. If the protective gear fails to operate the gas generation is so rapid that the oil must be regarded as incompressible.

Modern welded steel tanks are very strong, but other precautions have to be adopted; for instance, in the B.T.-H. transformers the conservator tanks are all fitted with large relief pipes, which are closed by special diaphragms to prevent the hot oil coming into contact with fresh air (which would help sludging), but which would fracture immediately the pressure rose a few pounds per sq. in.

By actual experiment on a tank 60 in. in diameter, the General Electric Co. (America) has found that the sudden generation of internal pressure of about 5 lb. per sq. in. will fracture such a diaphragm in under 1/100th of a second, and start a discharge at an initial rate of about 200 gallons per second. The total amount of oil discharged is not great, for in a few moments an open space becomes available for the discharge of gases, and then gases are discharged rather than oil. The discharged oil, being at a temperature of about 100 deg. C., is not in itself a fire risk.

The standard relief pipe has a horizontal discharge, the main object being to keep the internal pressure down to the minimum if a very heavy arc is formed under the oil. Every inch of pipe, and every degree of change of direction of the oil, adds greatly to the pressure. Where the horizontal discharge is not permissible, the discharge is taken at an angle of 45 deg. In such cases it is proposed that deflectors be provided to direct the oil into a convenient path, and if these are spaced clear of the relief pipe there will be no risk of siphoning the oil. Of course, the discharge must not be taken on to busbars, as arcing on them may quite possibly be the cause of the trouble in the transformer.

It is interesting to note how seldom the relief pipes are called upon to function. There are only about 10 cases on record, the writer understands, though over 15 million kVA of conservator transformers have been put into service.

The question has been raised of possible explosions in

the space at the top of the tank after some oil has been discharged, but this is unlikely as only gases, no air, will be present. It may also be asked whether a flare started above the oil level in a non-conservator transformer would raise the temperature of the remainder of the oil so that the fire would be cumulative. In all probability the fire would burn itself out as there would be no air to maintain it.

It has been proposed to arrange piping so that, should a fire start in the top oil in the transformer tank, all the oil could be drained away from the bottom of the tank. This appears to be a most unsatisfactory method. Not only would air be drawn into the tank, but the reduction of oil level would expose to the fire the insulating materials covered by oil films—an inflammable combination. Municipal regulations would not permit of connecting such draw-off piping to a sewer, and the provision of an adequate pit filled with gravel would introduce other difficulties. If the risk were a serious one, it would warrant the expense of installing piping to distribute chemicals to smother the fire. But, as stated before, a review of the situation indicates that the risk with modern designs of transformers is potential rather than actual.

Electro-Farming in Sweden.

Rural Electrification as a Paying Proposition.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

IT was very inspiring to attend such a lecture as that given by Doctor A. Ekström at the Institution of Electrical Engineers, for an interesting revelation was provided as to the progress of rural electrification in Scandinavia. Doctor Ekström has been engaged in rural electrification work for over 20 years, and has a 500-acre all-electric farm, which the writer has had the pleasure of visiting. A short time ago the farm buildings were burned down; however, this only gave the owner an opportunity to build even more modern ones on the ashes of the old and to employ the latest developments in electrical equipment and transporting apparatus, so that his farm is now a splendid practical example of what a farm should be. His general arrangements are so effectively labour-saving and labour-aiding that two men can look after, and also milk, 150 cows (the trade-union rate in England is 10 cows per man.) The kinematograph illustrations that he exhibited showed how much more advantageous it is to handle complete cartloads of crops in single lifts by means of electromechanical power than by the hand-fork-load customary in Great Britain. Very often in England hay is only worth, say, £3 a ton; yet a farmer will often spend nearly £3 more in man-handling that hay from the rick to the mouths of his livestock.

Though it was not mentioned in the lecture, it is interesting to remark, as illustrating the trend of modern farming, that various rural industries are now being incorporated as part and parcel of the farm routine, so as to level out the labour load factor. On Doctor Ekström's farm, a flour mill and a laundry are to be found. On the larger Continental farms it is now quite common to find these and other industries carried on, such as the production of alcohol, the brewing of beer, the manufacture of sugar from sugar-beet, the crushing of stones for road work, &c. In America, Henry Ford has come to the same conclusion —that farming is not a full-time job, and therefore needs some auxiliary enterprise to help it out. His proposition is that the farmers should employ their spare time in making parts of motor cars. In the case of most of the present farm rural industries, it is the crop that is produced on the farm that is being dealt with, and the refuse from the operation is fed to the livestock, thus saving transport. The possibility of carrying out such work is, of course, bound up with the supply of electricity, for if the latter were not available, power costs would be too high.

One of the most important points of Doctor Ekström's lecture was that rural electrification was carried out because it was *a paying proposition*. He freely admitted that a very large amount of money had been expended in the past in Scandinavia on rural electrification work, without adequate return; but now that experience has been gained, the proposition is a profitable one. This makes us all the more indebted to Doctor Ekström for so freely offering the data that have been obtained in his country, so that here the same pitfalls may be avoided.

In England, when threshing, it is customary to employ 12 to 15 men. Doctor Ekström showed how it was possible to do the same work with only four men. It is not the threshing machines that are at fault, for the most highly-favoured threshers on the Continent are of British manufacture, but though they pay their labourers less there, the foreign farmers seem long ago to have come to the conclusion that they cannot afford to employ as many men, and so they take advantage of electric power. In France, the writer came across a big British Clayton thresher, which was operated by one woman, who cut the bands of the sheaves and fed the machine, while a man wandered round with an oil can and took occasional samples to see that everything was working all right. The cheap farm-type of Temperley transporter gear that is employed is Scandinavia is also very largely used in Germany for handling complete cartloads of crops.

Very usefully Doctor Ekström drew attention to the best methods of wiring farm buildings. This matter is of far more importance than might be supposed, for farm conditions differ very greatly from those of the ordinary factory. In fact, the conditions more nearly approach those of a chemical works, owing to the presence of ammoniacal gases and uric acid in a humid atmosphere. Though Doctor Ekström has himself tackled the problems of electric ploughing and electric silage, in these two things Scandinavia is far behind certain parts of Europe. Still, one of the most practical forms of electric tractor plough is made in Sweden.

In the equipment of farms, the farmhouse should not be overlooked; hence, the description of the Seves electro-thermal storage cooker was very opportune. There have been many designs of thermal-storage apparatus, including a couple in this country, but this particular form seems to have attained considerably more success than any of its predecessors. Some 600 of these cookers are in use in Stockholm. Such a type of cooker should interest every electricity supply undertaking on account of its high load factor, as its consumption is a steady 600 watts; 300 watts of this is always on the block of cast iron, which serves both as a boiling plate and heat-storage element, while the other 300 watts is either on this block or is employed for heating the household hot-water supply. With a little diminution in the supply of hot water, this stove can be cut out by a time switch during peak-load hours, if so desired. The hot plate is probably the quickest electric boiler on the market, since it is maintained at a dull red heat. At such a temperature, it will be appreciated that it does not take very long to bring a utensil placed upon it to the boil. This cooker has already been described in the columns of the ELECTRICAL REVIEW, but it may be well here to emphasise

the point that the oven under the hot plate is intended for many of the simmering operations that are normally carried out on the top of an ordinary electric or gas cooker, thus replacing a couple of the hot plates usually employed. The roasting or baking oven is supplied separately; when this is in use, all the heat is temporarily switched off the main stove and, if necessary, additional heat can also be switched on to this extra oven. It will be appreciated that the ordinary cook will have to receive a little instruction in order to take full advantage of this improved form of cooker, as the idea of simmering things in an oven is novel to a person who has always been accustomed to do this on the top of a cooker. Further, such a simmering oven will carry out all the work of what is familiarly known as a "hay-box cooker," thus opening out a most useful field of cookery. The name of the cooker, "S.e.v.e.s.," is derived from the initial letters of the Swedish words for "Stockholm Electricity Works Electric Cooker." The German electricity supply authorities have been so much impressed with this cooker that they have decided to adopt it universally, and are making arrangements to do so in a very novel manner. While the ordinary arrangements for manufacture will be made with a commercial firm, the entire distribution is to be undertaken by an association which is the equivalent of the British Electrical Development Association. Further, these cookers are not going to be supplied to any household, unless the mistress or her cook will agree to take a week's instruction at the demonstration showroom of the local electricity supply undertaking. This is done for the obvious reason that these undertakings wish to make sure that the users fully understand the advantages that the new cooker offers. One of the principal German lady cooks is at present in Scandinavia, where she is gaining intensive practical experience in the use of the cooker. She has then to spend a fortnight in writing up a German instruction book, after which she is to return to Berlin and there give lectures and demonstrations to the chief electric cooks of each electricity supply undertaking, so that these ladies in their turn may become authorities on the subject in each town.

In this country, many difficulties are placed in the way of new ideas, and amongst these new ideas the subject of rural electrification has to be classed. In view of Doctor Ekström's paper, it should be possible to combat many of the objections and difficulties that have been raised, for it has been very ably demonstrated how profitable and effective rural electrification has become in Sweden, as the outcome of 20 years' experience. The prices at which energy is sold in that country can only be described as "reasonable." In fact, the prices in our large cities are very much lower. Then, again, Sweden is not such a wealthy country as ours, and the density of her rural population, whether it be taken per square mile, per route mile of cable, or per acre of arable land, is much lower than prevails here. This is a further argument in support of the contention that the conditions for rural electrification are even more favourable in this country than in Sweden—yet Scandinavia is far more fully electrified.

The Italian Electrical Industry.

Manufacturers Demand Further Protection: German Competition Feared.

[From Our Correspondent at Milan.]

ADDRESSING the International Electrical Congress held in Rome a few weeks ago, Signor Mussolini observed:—"Of all professions, that with most affinity to my spirit is the engineer's. If I were to further discriminate, my preference in the engineering field would be for those who study electrical engineering, because electrical energy is the fundamental element of Italy's possibilities." Whether this statement be well or ill-founded, certain it is that the metallurgical—particularly the electrical—trades of Italy have made progress during the past year or so; while it is probable that the full period of 1926 will mark further advancement in most of the more important branches of the industry. And yet, with all this to the good, Italian manufacturers of electrical apparatus and machinery are dissatisfied. They complain of the present position, and still more of that likely to arise in the immediate future. The non-fulfilment of their expectations has found expression in a long and dismal report, drawn up by some twenty-one members of the Confederazione Generale Fascista del l'Industria Nazionàle and presented to the Ministry of National Economy at a specially-convened meeting with that sympathetic Administration in Rome. From this plaint and the depressing tone of the discussion which followed its submission, it would appear that the increase in imports of foreign electrical machinery is having a bad effect upon the home industry. Manufacturers, therefore, demand that Signor Mussolini's Government should show its chief's expressed preference for Italian electrical engineering in a practical, rather than a merely sentimental, manner by imposing further and heavier import duties upon all supplies entering the country from abroad.

That some reason exists for the manufacturers' lament is proved by figures which they put forward. It seems that while in 1923 there were imported 35,000 quintals of electrical machinery worth 55 million lire, and much about the same quantity and value were noted in 1924, the total in 1925 reached 51,000 quintals, valued at 97 million lire. Things have become worse—from the home manufacturers' point of view—during the current year, since, for the first seven months, foreign electrical machinery entering Italy weighed 38,000 quintals and was worth 76 million lire, being at the annual rate of 64,800 quintals and worth more than 130 million lire. While it is not—and cannot be—asserted that Italy could herself produce in the workshops of her country the whole of these goods, it is contended that a great deal of them could be supplied equally well locally, and relief to this end is urgently demanded.

The determination to dispense so far as is possible with electrical products derived from foreign sources has been likewise voiced by the Association of Italian Electricity Companies, which, by circular, recently requested its members to abstain from the purchase of foreign machinery, particularly electric motors and transformers. In order to render more attractive the acceptance of Italian offers for this class of machinery, the Association has undertaken to pay "compensation" of at least 5 per cent. This unusual action was no doubt suggested by the large amount of German and French machinery entering Italy due to the depreciated currencies; but now that the franc has recovered a good deal of its lost ground, this particular channel of invasion of Italian territory is likely to become closed.

The Government's good intentions towards helping the national industry cannot be doubted. Recently it guaranteed a loan of 95,000,000 lire for the further encouragement of electrical undertakings, especially those established in the south of the Kingdom. It may be likewise remembered that some three years ago a loan of

65,000,000 lire was made for similar purposes, the Government, as on the present occasion, standing as guarantor. That the money has been used to good purpose is proved by the number of new hydro-electric establishments opened in the neighbourhood of Naples and of Palermo (Sicily) respectively, and by several others that are fast approaching completion in the districts of Calabria and Puglia.

The more healthy condition of the electrical position, so far as production and sale of energy are in question, is to be observed from a study of recent figures furnished by the Italian Association of Electric Power Companies. From these statistics it appears that the capacity of the power plant installed increased from about 1,000,000 kW in 1914, to 2,107,500 kW at the end of 1924, and to 2,369,000 kW at the end of 1925. At the end of the current year the total will, it is estimated, reach close upon 2,500,000 kW.

The growth in the consumption of electric power has been remarkable. Whereas in 1914 the power installed amounted to 1,360,000 h.p., by the end of last year (1925) the power stations possessed a capacity of 3,200,000 h.p. The power actually consumed exceeded 7,600,000,000 kWh, of which about 8½ per cent. was employed in lighting and the remainder in power and traction. The largest consumption, averaging between 400 and 500 kWh. per head per annum, is in the northern part of the Kingdom. In the south, the average is a little less than 50 kWh.

In regard to kilowatt-hours, the power produced in 1914 was equal to 70 per inhabitant, while in 1925 it was equal to 185 per innabitant. At that period there were just under 80 new power plants in course of construction, with a total capacity of 1,200,000 kW. To-day several of these have been completed, and are now adding their contribution to the total capacity. There are in course of construction 47 mountain reservoirs or artificial lakes, with a capacity of 700,000,000 cubic metres. Inasmuch as the existing reservoirs are capable of containing 860,000,000 cubic metres, there will eventually be available a total reserve of 1,560,000,000 cubic metres of water to make up any deficiencies in the dry season. Within the next three or four years there should be an annual production of 10,000,000,000 kWh. Even then it is probable that the demand may not be fully satisfied, since the rate of increase of the demand is now about 13 per cent. per annum. At the end of 1923, the capital invested in the electrical industry was 2,864,000,000 lire; by the end of 1925 it had increased to 6,174,000,000 lire, and the annual rate of increase is now being maintained at an equivalent of about 1,650,000,000 lire, or, say, £15,000,000.

Northern and Central Italy continue to form the two most important centres of the metallurgical industry, although fairly large establishments, such as those at Torre Annunziata, Pozzuoli, Castellamare and Barí, have been introduced into the south. The industry seems likely to maintain a favourable condition, and, indeed, to become eventually the second most important enterprise in the country. For several years to come there must be a large demand for many classes of machinery to equip the irrigation and other schemes calling for hydro-electric and allied plant. Were the mechanical, engineering, iron and metallurgical industries relieved of still-present administration difficulties, and could they be placed upon a more independent financial footing (which numerous adjustments and readjustments have failed so far in effecting) there would be still less demand for foreign imports. In the case for instance, of the Società Esercizio Telefoni, of Naples, which took over from the Government the local telephone service, the whole of the electrical equipment, including automatic switchboards, is now being made by the company.

The lack of raw materials, however, still proves one of the principal obstacles in this country's industrial progress. Unlike other countries, Italy is almost entirely without local deposits of coal of an industrial grade, and possesses but one single source of iron ore, namely, that on the island of Elba. Other materials, with the exception of mercury and sulphur, are either scarce or are found at almost inaccessible points.

The raw materials obtained from Italy's mines being insufficient for the needs of the metal and engineering industries, they are constrained, consequently, to draw largely on foreign countries. The total imports of cast iron, wrought iron, and steel increased from 46,000 tons in 1922 to 69,000 tons in 1925, the United Kingdom providing the greater part of these imports, and considerably advancing its contribution of iron and steel in bars, ingots, strips, wire, &c., but not of scrap and cast iron. Last year Italy produced 400,000 metric tons of cast iron and 1,500,000 tons of steel, in comparison with 267,000 tons of cast iron and 1,200,000 tons of steel in the previous year (1924).

It may be remembered that towards the middle of 1922, when the question of the reparations goods which Italy should import from Germany was in question, the Italian Government arranged a meeting with the Reparations Committee to discuss the situation and its serious threat to existing or future Italian manufactures. In the end, a compromise was arrived at upon the recommendation of the Italian Committee which had been appointed to draw up two programmes, one for 1922 and the other for 1923. By the terms of these it was arranged that a large number of products which Germany could not supply at all, or could not supply in the required quantity, should be excluded from importation into Italy. Among the former articles were six types of materials, and in the latter there were three. The greater part of the material demanded consisted of electrical machinery which the Italian Government would be able to sell, under favourable conditions, to national companies which had undertaken to enter upon hydro-electric construction. This explains why, when going over some of the large Italian power houses, visitors have sometimes noted, not without surprise, a proportion of German manufactures installed. To-day, however, the importation of heavy German machinery is being reduced as much as possible in order that local manufactures may take its place.

German competition in the supply of electrical apparatus and materials, including fittings, insulating cloth, iron alloys for transformers and motors, copper wire, silk and cotton for binding, and insulating varnish, is felt, notwithstanding the high tariff wall which has been erected around this—among other industries. There is evidence, however, that this competition may eventually be met and largely overcome, more especially in view of the inferior quality of German manufactures finding their way abroad, and their failure to come up to anything approaching sample. In certain supplies of electrical fittings Italy can compete far more successfully, being able to sell as much as 20 and even 25 per cent. below foreign quotations. For some time, however, there must continue to be imported a variety of types of electrical apparatus, especially telephonic and telegraphic, which are not as yet made in sufficient quantities in the country. To-day, the principal proportion of foreign goods of this class is being received from the United States and Switzerland, in addition to Germany.

For British electrical materials of any kind there appears to be little or no demand; the one-time market for electric motors, largely supplied from the United Kingdom, has been closed. Italy now makes these machines in her own workshops, and they are often found running in conjunction with imported machinery. Local industries have also been established for the turning out of larger quantities of electric lamps, formerly imported in very large quantities from Holland. The Dutch factories, however, still furnish a considerable proportion of Italian requirements.

Where Italian initiative is displayed, a considerable measure of success usually follows. There is the case of the well-known Turin firm of Fiat, which scored an undoubted success with some new electric steel furnaces. These were the first to be introduced, and date from 1923. The earliest equipment, comprising four large electric steel furnaces of 15-20 tons each and two of smaller size, from 3-6 tons individual capacity, did not

immediately answer the requirements; during the past three years, however, efforts have been made successfully to overcome the earlier defects. The Fiat firm has received inquiries from a number of metallurgical works regarding furnaces of the 4-8-ton type. While the furnaces are of Italian manufacture, it should be added that they are of German design, the patentees being Messrs. Demag, of Duisberg, who work in conjunction with the A.E.G., of Berlin. Prior to the war, this company, in association with the Siemens-Schückert Company, furnished the greater part of the electrical machinery used in Italy.

Among large machinery, generators and motors of numerous types take precedence. For the many central power and distributing stations now established throughout the country, the switchboards are almost entirely of local production. Here and there American or German types are to be found, but in a number of installations they are gradually being overtaken by manufactures wholly Italian. Alternators are being built up to a capacity of over 15,000 h.p. Upon the newly electrified railways, three-phase electric locomotives from Italian shops are being used. These have direct-connected motors with power applied to all wheels, and a speed is maintained of 19 miles per hour when hauling trains of 500 tons on the heaviest grades.

The first Italian plant for the production of electrolytic iron was started at the beginning of this year at Turin under the patents of the French company "Le Fer," of Grenoble. The pig iron is brought into contact with the anode, and, during the melting process, pure iron deposits itself on the cathode. By pouring the fused metal into moulds, weldless tubes, plates and objects of any shape can be made. The Turin plant renders it possible to manufacture thin-walled bottles, carboys and tanks for the transport of gas. Experiments have also been made with the Perin patent (U.S.A.) which, instead of dealing with pig iron, permits of treating the iron ore directly. It is hoped that this process will prove the more successful of the two, since Italian pyrites would then find profitable utilisation.

The recognition outside of Italy of the skill displayed by Italian electrical engineers, often conceded, was again testified to at the meeting of the Union International des Producteurs et Distributeurs d'Energie Electrique held recently i Paris, when regret was expressed by several of those present that Italian electrical power companies did not induce their engineers to read more technical papers before foreign—and especially British and French—engineering societies, thus affording both to them and the profession generally the benefit of their great skill and experience.

Lightning Action Phenomena.

The Production of Fulgurites.

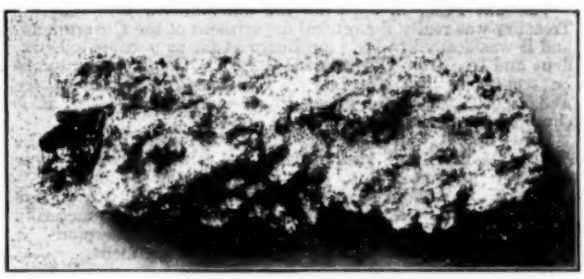
By KILLINGWORTH HEDGES.

FULGURITES (Fr. fulgarites, pierres foudroyées; Ger. Fulguriten, Blitzröhren, Blitzsinter), as their name implies are fused tubes, or other structures, produced in sand and earth by the action of lightning; a formation of holes in rocks of high mountains is attributable to the same cause, the surface of the part struck being coated with a glassy crust, resembling a film of varnish of about ¼ in. thick. De Saussure in his alpine travels between 1768 and 1789 found small blackish beads on the face of some slaty horn blende on the Dome de Gouté, and other travellers have noticed the holes on Mt. Ararat, and in the Alps and Pyrenees.

Fulgurites found in sand take the form shown in the accompanying illustration which is three-quarter size of the natural specimen at the part just below the surface; lower down they branch off like the roots of a shrub and become flattened, probably by the pressure of the sand, and they sometimes extend to a considerable depth, by no means perpendicular. They have in some cases been followed to over 10 feet, but owing to their brittle nature the specimens dug up are generally short.

The fulgurites from the Kensington Sandhills, New South Wales, described by the late F. W Grimshaw M.Inst.C.E., in a paper read before the Austrlian Association for the Advancement of Science, Sydney, 1898 present no new features as regards their form or general character. Externally they are rough, somewhat whiter than the surroundings, and inside they are enamel-like, from the glassy surface of the fused silica. Under the microscope the fused material is seen to be full of small vesicles. A sample of the sand fused in a oxyhydrogen jet presented an almost indentical appearance, and in chemical composition the fulgurites appeared to be substantially the same as that of the sand. Those found varied from about 25 mm. to 5 mm. in diameter, the thickness of the walls being also variable, but generally from 1 to 2 mm.; the shape is more and more irregular towards the extreme ends, the hole almost closing up at the points; outside the tubes is a well-defined band of reddish sand of a thickness of about 3 mm.

Fulgurites were made artificially by Bendant* in 1828. Powdered glass was used, and also glass and salt, the latter being the more easily fused. The glass gave a tube of 25 mm. in length, with end diameters of about



A Fulgurite Formed in Sand.

3 mm. and 1½ mm., the interior diameter being about ½ mm; with salt added a tube 30 mm. long was obtained, with an average diameter of 4½ mm., the interior diameter being 2 mm.

No reason for the more or less circular hole in fulgurites has been given, and the writer is of the opinion that it is due to the whirling action of the flash causing the fused sand to take the shape of a tube. This circular movement has been noticed in some fir trees, the lightning stripping the bark in a spiral line of almost mathematical regularity. The circular shallow holes on some mountain peaks, said to be due to lightning, are probably caused by a similar whirling action. The author's attention was first directed to this effect when examining the base of the pointed tower of a church which had been badly damaged by lightning. It was found that the blocks of stone at the base had been moved to a position which corresponded to the diagonal fracture of the spire; the force of the stroke had evidently displaced the stones in a circular direction.

The illustration is from a photograph of a specimen lent to the writer by the late Captain Philip Cardew, R.E. and gives a definite idea of the appearance and characteristics of fulgurites produced by lightning striking loose sand.

Improved Boiling Plate.—With a view to giving the element absolute protection against spilled liquids, Messrs. Wm. Geipel & Co., Vulcan Works, St. Thomas Street, London, S.E.1, have slightly altered the construction of their "Quead" high-efficiency boiling plate (ELECTRICAL REVIEW, July 9th, 1926, p. 77). The movable trivet which supported the cooking utensil in the old model has been replaced by a cover plate which entirely encloses the element. It is claimed that only a very slight reduction in the efficiency of the apparatus results.

* Expérience sur la formation des tubes fulminaires Annal. Chim. et de Physique 37. Pp. 319-321, 1928.

The Electricity (Supply) Bill.—III.

Proceedings in the House of Lords.

THE House of Lords, on November 30th, disposed of the Committee stage of the Electricity (Supply) Bill in one sitting of "record" length for modern times, beginning at 4.15 p.m. and ending at 1.20 a.m. on December 1st.

On Clause 1 (Constitution of the Central Electricity Board), Lord MONTAGU OF BEAULIEU moved an amendment to provide that the proposed Board should consist of a chairman and eight members, instead of a chairman and seven members. He contended that the eighth member should be a representative of agriculture.

Viscount PEEL, who represented the Government during the debate, opposed the amendment, explaining that it was not intended that the Board should be composed of the representatives of different industries and occupations; but that it should be composed of seven members and a chairman of wide experience in business who, if possible, should not be directly representative of any industry, but should very impartially consider the interests of all. It was obvious that if a statutory right was given for a representative of agriculture to go on the Board, all the other industries and interests would require the same treatment.

The amendment was, by leave, withdrawn.

Lord MONTAGU OF BEAULIEU then moved an amendment to provide that the Commissioners of the Treasury should appoint the members of the Board, instead of the Minister of Transport. As no less than £33,500,000 of public money was going to be advanced, the Treasury should have the right of nominating the members of the Board, and not the Minister of Transport.

Viscount PEEL, in opposing the amendment, said that the Treasury was really the central department of the Government, and it was desired to keep the Board as far as possible independent and free from Government control. The Treasury might be trusted to look after its own interests in regard to the £33,500,000, and could make what conditions it liked, if it chose to guarantee the money.

Lord CARSON strongly supported the amendment. The Board, he said, had vast powers, and the question of those who were appointed to it was one of great importance.

Earl BUXTON pointed out that vital and extensive powers were to go to a Board which was for five years to be practically independent of control by the Government. Therefore, it should be nominated by a very powerful department.

Lord DANESFORT contended that the Treasury should have some control over the Board.

The LORD CHANCELLOR said that the Board was not a financial one; public money could be spent by it or entrusted to it without the consent of the Treasury. For the purpose of checking the expenditure the Treasury would be in a stronger position if it did not itself appoint the Board. The Electricity Commissioners were responsible to the Ministry of Transport, which was the proper administrative department for choosing the members of the Board.

Lord GAINFORD said that those associated with electrical undertakings believed that the operations of the Bill, in setting up a new Board, instead of cheapening electricity would do exactly the reverse, and the establishment of such a Board would inevitably mean that there would be a new spending department to be dealt with. The Treasury attitude of mind was really to see that individuals who would be appointed on the Board would do what they could to restrain expenditure on a large scale by the new bureaucratic body. It was for that reason, as well as in the interests of the loans to be secured by this new body, that it was far more important that the Treasury should be represented than the Ministry of Transport in connection with the nomination of persons to serve on the Board.

After further discussion, the amendment was rejected by 78 votes to 31.

Lord MONTAGU OF BEAULIEU moved an amendment to include agriculture among the interests which might be consulted by the Minister before appointing the Board.

Viscount PEEL accepted this amendment, which was agreed to.

Viscount BERTRE OF THAME moved an amendment to make applicable to all members of the Board the requirements imposed in the Bill on whole-time members only that they should sell any securities which they might hold for their own benefit in any electrical concern.

Viscount PEEL said that in the case of part-time members it would be a sufficient safeguard if they disclosed any interest they might have in any electrical company, and that to make them sell out any such interest would be an obstacle against obtaining the services of some men of great knowledge.

The amendment was negatived.

On an amendment moved by Lord MONTAGU OF BEAULIEU, to provide that six members of the Board should be a quorum, the Lord Chancellor undertook to bring up a quorum clause on the Report stage, and the amendment was withdrawn.

On Clause 2 (General Powers and Duties of Board), Lord ASKWITH moved the insertion of the following new sub-section:—"(3) Where proposals are made to the Board by any association of owners of generating stations which, by virtue of this Act become selected stations within an area for which a scheme has been adopted under this Act for the delegation to the association of any powers and duties of the Board within that area, then, if the Board is satisfied that the association making the proposals is a fit and proper body to carry out those powers and duties, the Board shall comply with the proposals if and so far as they consider it practicable to do so without prejudice to the efficient discharge of the general duties of the Board or to the efficient execution of the scheme within the area, but subject to such conditions as the Board may think fit to impose." He said the chief object of the amendment was to make quite clear the intent and meaning of the Bill, that it was not to produce a State-managed supply system, but to obtain a more closely-knit industry as between the existing undertakers.

Viscount PEEL reminded the House that there were certain matters which, later in the Bill, could not be delegated.

The amendment was agreed to, as was an amendment moved by Viscount PEEL to make it clear that the power of adopting schemes or framing a tariff could not be delegated.

On Clause 3 (Appointment of Consultative Technical Committees) a drafting amendment, moved by Viscount PEEL, to make it quite clear that the Board would have power to interconnect areas by h.p. cables, was agreed to.

On Clause 4 (Preparation and carrying out of Scheme), Lord MONTAGU OF BEAULIEU moved the addition to the purposes of a scheme the following:—"(c) Providing for transforming stations and transformers on the main transmission lines, at intervals of not more than 10 miles apart, in order to make a supply of electricity available at pressures suitable for use in agriculture and rural industries and for domestic purposes." He said that, unless some such provision were inserted in the Bill, agricultural centres would, he feared, be left out.

Viscount PEEL said that under the Bill the Board would have power to put down these transformer stations. In the Act of 1919 the definition of transmission lines included transformers. It would be a very large change in the present Bill at that stage to introduce distribution as well as generation.

The amendment was withdrawn, Lord MONTAGU OF BEAULIEU intimating that he would move it in another form on the Report stage.

An amendment by Viscount PEEL, to make it clear that where compensation to be awarded was only in money there was no reason why the scheme should be held up, was agreed to.

On Clause 6 (New Selected Stations), Lord ASKWITH moved the insertion of the following new sub-section:—"Provided that where a new generating station is required in the area of supply of a company which is a London company within the meaning of the London and Home Counties Electricity District Order, 1925, such company shall have the first option of providing such station."

Viscount PEEL said that the amendment would take away a certain right from the J.E.A. and give it to one of the companies. It seemed clear that the J.E.A. was the proper body to have the first option of supplying a new station anywhere in the district.

The amendment was negatived by 78 votes to 20.

On Clause 7 (Obligations and rights of owners of selected stations) Lord BANBURY moved an amendment to allow a selected station to provide electricity for its own customers.

Viscount PEEL said that the amendment would strike at the root principle of the Bill, which was that the Board should control generation at all the selected stations.

The amendment was negatived.

On Clause 11 (Tariff for electricity supplied directly by the Board), an amendment, moved by Lord FORRES, that the fixed kW charges component and the running charges component should be ascertained in accordance with such principles as might be approved by the Electricity Commissioners, was accepted by the Government and agreed to.

On Clause 14 (Power to close generating stations in certain events), Lord ASKWITH moved to insert:—"(5) Where the cost to the undertakers of taking the whole of their supply, directly or indirectly, from the Board, as provided for in sub-clause (1) hereof, will be more than the then prevailing cost to those undertakers, the Board may come to an arrangement with the undertakers whereby the undertakers agree to take the whole of their supply of electricity from the Board, directly or indirectly, on condition that the Board agree to repay to the undertakers any expenditure necessarily incurred by them in carrying out a change of their system of supply from a direct-current system to an alternating-current system, such payment to be provided for by the Board in like manner to the payments made under clause 9 (1) and (2) hereof." He said that the amendment was moved in order to provide for cases where, on the assumption that the Commissioners did not extend or allow an extension of an existing station, or allow a new generating station, the undertakers were most anxious to increase their supply, and then were told that they might have to take an a.c. supply from the Commissioners, and at the very end of their tenure have to alter their lines so as to take alternating, instead of direct, current. That would cause very heavy expense, without any possibility of recoupment.

Viscount PEEL promised to look into the matter, and the amendment was withdrawn.

On Clause 18 (Saving for necessity of obtaining certain consents), Viscount PEEL moved to insert:—" (2) Where an application is made by any authorised undertakers to the Minister of Transport or the Electricity Commissioners for their consent or approval under the Electricity (Supply) Acts, 1882 to 1922, in any case where such consent or approval is by those Acts required, the Minister or Commissioners, in determining whether to give or withhold the consent or approval, shall have regard to the provisions of this Act and the effect of any scheme or proposed scheme thereunder." He said the purpose of the amendment was simply to prevent any conflict between the provisions of the scheme and any subsequent consent of the Minister.

The amendment was agreed to.

An attempt by Lord BANBURY to omit Clause 27, empowering the Treasury to guarantee loans to the Board, was negatived, as was also an attempt by the same noble lord to omit Clause 29 (Charges for electricity supplied by power companies).

On Clause 32, dealing with the lopping of trees and hedges, Lord MONTAGU OF BEAULIEU moved a new sub-section to provide that regard should be paid to the antiquarian or artistic value of buildings, forests, &c., and that, if required by the local authority, an undertaker should lay cables underground, any dispute to be referred to the First Commissioner of Works.

Viscount PEEL thought that it was impossible to place the h.p. cables underground, and the amendment was withdrawn.

Viscount PEEL accepted an amendment, which was agreed to, moved by the Earl of MALMESBURY, to protect country hedges.

On Clause 37 (Terms of purchase of a company taking a bulk supply) the following new sub-section, moved by Lord ASKWITH, was agreed to:—" Where, under the Electricity (Supply) Acts, 1882 to 1922, or under any order made thereunder, or under any deed of transfer executed in pursuance of powers conferred by any such order, or under any special or local Act, any right to purchase the whole or any part of the undertaking of any authorised undertakers is vested in a local authority (including a joint electricity authority), the authorised undertakers may at any time within 10 years before the date of purchase next occurring after the passing of this Act, or within 10 years of any subsequent date of purchase enter into a contract with the local authority to amend, vary or alter the terms of purchase on the next occurring date upon which they may purchase upon conditions to be agreed between the parties with the approval of the Electricity Commissioners, and the terms of such agreement shall be binding upon the parties."

After Clause 42 (Supply of electricity by railways, &c.) the following new clause, moved by Viscount CHURCHILL, was agreed to:—" Where any authorised undertakers may supply and are supplying within their district or area of supply electricity for haulage or traction to any company or authority being the owners or lessees of a railway, tramway, dock, harbour or canal undertaking situate partly within and partly without that district or area, such authorised undertakers may, subject to such limitations and conditions (if any) as the Minister of Transport may prescribe either generally or in any particular case, so supply electricity to be used for any purposes of such undertaking, whether within or without such district or area of supply, and such company or authority may, subject to such limitations and conditions (if any) as the Minister of Transport may prescribe either generally or in any particular case, use the electricity so supplied for any purposes of their undertaking for which they are entitled to use electricity."

On Clause 43 (Sale of fittings), the Duke of MONTROSE moved an amendment to provide that the J.E.A. or local authority " shall not for sale by direct labour execute any wiring of private property or undertake the supply direct to the consumer of the fittings or materials for such wiring except between the main of the authority and the consumer's meter. The joint electricity authority or local authority may, however, enter into contracts with an electrical contractor for the execution of such wiring of private property, including the supply of the necessary fittings and materials, provided the contractor acts independently of the authority in the execution of the contract." The Earl of DONOUGHMORE, Chairman of Committees, strongly resisted this new clause, which, he said, would break the agreement arrived at by the British Electrical and Allied Manufacturers' Association, Incorporated; the Electric Lamp Manufacturers' Association of Great Britain, Ltd.; the Electric Fixtures Association; the Electrical Accessories Manufacturers' Association; the Electrical Contractors' Association, Incorporated; the Electrical Wholesalers' Federation, Ltd.; and the Incorporated Municipal Electrical Association. Those seven bodies claimed to represent £250,000,000 of capital and 500,000 workmen.

The amendment was rejected by 36 votes to 5.

The Committee stage was concluded, and the Bill reported to the House.

Northampton Institute.—The annual prize distribution and members' and students' conversazione of the Northampton Polytechnic Institute was held on Friday and Saturday evenings last. The prizes and certificates were presented by Mr. W. H. Webbe, C.B.E., chairman of the Education Committee of the L.C.C.

South African Notes.

(From Our Durban Correspondent.)

Union Government Regulations.

MUNICIPAL electrical engineers in South Africa are rather perturbed over the recently-published draft additions and amendments to the Mines and Works Regulations which control power stations and distribution schemes, and for that reason the members of the Council of the Association of Municipal Electrical Engineers met in Johannesburg early in November to discuss the proposals. A joint meeting was also held with representatives of the South African Institution of Electrical Engineers, and the outcome was that it was felt that while Regulations were necessary for electrical undertakings, such Regulations as applied to mines and works could not be applicable to electrical undertakings of municipalities, which needed separate consideration. Further than that, it was felt that all Government regulations relating to municipal electrical undertakings should be co-ordinated in one Act rather than as at present, when the Post Office has a controlling Act, the mines and works have another, and the railways again have their regulations, all differing from each other in some respects.

A small sub-committee of the Association was appointed to join forces with the Institution in asking that the respective bodies be included in a drafting committee under the Government's representatives to go fully into the proposals, and it is hoped that the Electricity Supply Commission will also have representation, so that regulations relating to municipal electrical undertakings will be put on a sound basis.

'Buses versus Trams.

The burning question of " 'Buses *versus* Trams " was the subject of a conference held in Johannesburg early in November, at which representatives of every big town in South Africa were present. The conference was opened by the Mayor of Johannesburg, and Mr. G. B. Milford, chief of the Johannesburg tramways, was elected chairman. It was freely admitted that the private motor-'bus was very seriously affecting the finances of the Tramway Department by reason of private enterprise not being required to work on standard rates of pay or hours of labour. It was, however, proposed by Mr. Hardy Lambe (East London), " That in the opinion of the conference, in the public interests, there exists an urgent need for legislation, the object of which will be the controlling of the public passage of transport within municipal areas." This resolution was carried with acclamation, and it was further decided to form an " Association of Road Passenger Transport Officials of South Africa." The conference continued for three days, the agenda being as follows:—Transport Problems; Fares and Stages; Ticket Check; and Statistical Returns. The delegates were entertained to lunch by invitation of the Mayor, and visits were made to the power station and car sheds, and the tramway system was inspected.

The Electrical Power Engineers' Association.

West Yorkshire Section—Annual Dinner.

THE fourth annual dinner of the West Yorkshire Section of the Electrical Power Engineers' Association was held on December 4th, at the Hotel Metropole, Leeds, and a large number of members and ladies were present. The section chairman, Mr. A. J. S. Waddell, A.M.I.E.E., presided over the gathering, and during the evening a mahogany electric stand reading lamp was presented to Mr. W. C. Wilkinson, the late hon. secretary of the section. Mr. WADDELL, who made the presentation, said that if the history of the E.P.E.A. was ever written, one of the outstanding features of it would be the enthusiastic and self-effacing interest shown by its hon. officials, gentlemen who sacrificed their leisure and home engagements for the benefit of the Association. Particularly did this apply to Mr. Wilkinson, who had had to resign office for health reasons. During his two years of office he had carried out his duties in a most assiduous manner. He expressed the hope that the relief from responsibilities would go a long way towards Mr. Wilkinson's speedily regaining his normal vigour. In response, Mr. Wilkinson expressed his great appreciation for the gift.

In proposing " The Association," Alderman D. B. FOSTER said the Association had ideals not only for looking after the interests of its members, but also for the benefit of the public, whose servants were its members. Speaking as the chairman of the Leeds Electricity Department, he was convinced that his department gave a very adequate electricity supply, but, looking ahead, it had already secured the sanction of the Electricity Commissioners to commence building another station, which he expected would be the finest in the kingdom. The department had secured a site of 104 acres, bounded on the north by the River Aire, and on the south by the canal, whilst right through the centre of the site ran the L.M.S. main line railway. He could almost visualise that such large centres as Leeds, Bradford, and Sheffield could, under the proposed Electricity (Supply) Bill, be made the centres for

the supply of electricity for the whole country. Such associations as the E.P.E.A. must take their share of the responsibilities of electrifying the country.

Mr. A. J. OSTLER, A.M.I.E.E., president of the E.P.E.A., said that progress was being made in the endeavours of the Association to obtain sanction for a scheme for the proper training of assistant engineers. Through the offices of the National and District Joint Boards many very useful things had been brought to fruition for the benefit of the industry. The body he represented did not wish to overlook the fact that it was only by the co-operation of both sides that the industry could progress. With regard to the Electricity (Supply) Bill, the Association was prepared to do all it possibly could to ensure its success, or that of any other national scheme which might be put forward. They were out for the best possible service to the community as a whole. He was convinced that on the N. & D. Joint Electricity Boards they had got that new spirit in industry which all were looking for.

Mr. A. L. LUNN, M.I.E.E. (Manchester) proposed "The National and District Joint Boards," and remarked that these Boards were instituted during his period of office. Since their last dinner in Leeds the Boards had done a lot of work, and the country owed a debt of gratitude for the efforts put forth during the recent emergency conditions which were brought into force last May. If every industry followed the example set by the electrical section, such difficulties as we had passed through during the last six or eight months would never have been allowed to be created. With regard to the Electricity Bill, the question as to who were its sponsors did not matter; the important thing was that it was something of truly national good for the benefit of our country as a whole. The position of the Association to-day was probably better than many members realised.

Councillor H. R. WEBSTER, chairman of the Harrogate Electricity Department, responded, and also paid tribute to the very fine work done by the N. & D. Joint Boards. The sole aim of the Boards was to see that justice was obtained. He was glad to find that from the E.P.E.A. side they were able to send representatives who were equipped by practical knowledge to state their case, and, from an educational point of view, use arguments which were most effective. In his opinion there were some weaknesses in regard to the Bill which would have to be eradicated or strengthened before it left the House of Lords.

The toast, "The Ladies and Guests," was given by Mr. A. WILLIAMS, A.M.I.E.E. (Manchester), and responded to by Mr. N. MCLEAN, of Harrogate.

Mr. TELFORD, of Sheffield, proposed "The Chairman of the West Yorkshire Section," to which Mr. WADDELL suitably replied.

The Manchester Association of Engineers.

The Presidential Address—The Government's Electricity (Supply) Bill.

AT the opening meeting of the 1926-27 session of the Manchester Association of Engineers, the presentation of medals included the Constantine medal to Mr. D. Adamson for his paper on "Electric Overhead Travelling Cranes," the Butterworth medal to Mr. F. Walker, A.M.I.E.E., for his contributions to the discussions, and the presentation to the Association of a president's badge.

The presidential address, by Sir B. LONGBOTTOM, M.I.E.E., reviewed "Engineering Development during the 20th Century." He said, *inter alia*, that the electrical industry had become a key industry upon which other staple industries were dependent, and outlined the development of the Manchester Corporation's electricity undertaking, as it afforded a good idea of the development of electricity supply throughout the country. He explained that the Government's Electricity (Supply) Bill, put in its simplest form, proposed to put the whole country in the same position as Manchester with regard to generation and distribution. Instead of towns being self-contained electrical units, the whole country was to be the unit. He concluded:—"The total output at present from all generating stations in the country is 7,000 million kWh per annum, and it is estimated that this figure will be trebled in 15 years, and more than trebled if extensive main-line railway electrification is carried out. As the output of the Manchester undertaking is about 300 million kWh per annum, it is obvious that 23 'Manchesters' could supply the whole of the country's present requirements. The average price per kWh obtained in Manchester is 1.122d., against an average of 1.75d. throughout the country. Hence, if all stations were as efficient as that at Manchester, the average charge would be reduced nearly 35 per cent., which represents a saving of over £17¼ million on the national consumption. If the generating costs per kWh were as low as at the Barton station, the saving would be greater still, for Barton has the distinction of having the lowest fuel consumption per kWh of any station in the kingdom.

"For some years the process of adjustment to the new system created by the Electricity Bill will probably hold up electrical development slightly, but, the present annual rate of expansion in output, namely, 700 million kWh, equivalent to about 500,000 kW of new generating plant, can scarcely meet the needs of the country as a whole. The coal miners' dispute also has imposed a serious check on progress, and we shall be fortunate if, in the year ending March, 1927, we do not register a decline of at least 10 per cent. from the total of 1925-26. The total aimed at under the new scheme, namely, 21,000 million kWh annually, assuming that industry derives all its electrical power from the public supply undertakings, will, at our present percentage rate of progress, materialise only 12 years hence. We must shorten this period to five years if this country is going to draw even with Germany, France and Italy, but, until the important schemes held up by the Electricity Bill come into operation, there is little prospect of acceleration.

"We are on the eve of great developments; industry is entering on a new phase of re-organisation The railway companies must very soon decide how they intend to deal with the increasing menace of road transport. The evidence recently submitted by the National Farmers' Union and other bodies, to the Railway Rates Tribunal, showed that there is close community of interests between agriculture and rail transport. The frank recognition of this fact should lead to co-operative effort, which would benefit both parties, and joint application to the Central Electricity Board might result in the establishment of high-voltage transmission lines along the railways, with convenient sub-stations from which a supply of electricity could be taken both to the railway track and to the adjacent agricultural areas. Light electric railways with motor trucks could be run to recognised collecting centres, and so relieve the road of much of the heavy traffic, and expedite the delivery of perishable goods. Electric power could then be gradually adopted, both on the main lines of railways and for agricultural and dairy farming operations, which would not only be of mutual benefit, but would serve the highest national interests, as the traffic would be handled more economically and expeditiously by electrification, and farmers would have placed in their hands a tool which would enable them to increase the productivity of the soil and make farming a more attractive and prosperous industry."

London Transport.

Reports of the London and Home Counties Traffic Advisory Committee.

LAST week two reports were issued by the Ministry of Transport, relating to the public inquiries respectively held in October, 1925, with regard to the travelling facilities in North and North-East London, and in March, 1926, with regard to the facilities in East London (H.M. Stationery Office; price 1s. each, net).

The former dealt with an area extending from Islington and Stoke Newington northwards to Cheshunt and Waltham Holy Cross, and from Tottenham and Edmonton in the east to Finchley and Barnet in the west: the inquiry lasted ten days.

The Committee, after careful consideration of the evidence and data placed before it, came to the following conclusions:—That the difficulty of passenger transport between the districts north and north-east of Finsbury Park and the Central London Area is primarily due to the fact that there has been no adequate increase in "through" travelling facilities from those districts to meet the large increase in population which has taken place during the past quarter of a century. The lack of efficient and rapid transport facilities has retarded the development of the area; given adequate and rapid transit an increase of at least 50 per cent. in passenger traffic might reasonably be expected in the course of the next few years.

It is clear that the London and North-Eastern Railway Company, so long as it adheres to "steam" working, cannot render any material assistance towards a solution of the problem.

Following upon these conclusions, the Committee makes the following recommendations, which are primarily based upon the conviction that the requirements of the area can only be adequately met by the provision of additional "through" railway facilities:—

That the London Electric Railway Company should be invited to give serious consideration to the question of extend-change station at Manor House, with a view to its provision future, and that in conjunction with the Metropolitan Tramways Company it should examine the proposal for an interchange station at Manor House with a view to its provision at the earliest practicable date. Even if it were decided to extend the Piccadilly Railway to Wood Green or beyond, the provision of the suggested interchange station at Manor House would be invaluable, as the districts of Tottenham, Edmonton, and the eastern part of Enfield would continue to rely largely upon the tramway services running to and from Manor House. Any such interchange station should be made available for general use by both tramways and omnibuses.

In addition, the London Electric Railway Company should be invited to explore the possibility of extending the Piccadilly Railway to Wood Green or Southgate.

The Committee considers it desirable to obtain additional information upon the subject of the electrification of the

suburban sections of the London and North-Eastern Railway Company's lines, and proposes to take steps towards this end. The Committee also proposes to investigate further the practicability or otherwise of the provision of a physical connection between the Great Northern and City Electric Railway and the London and North-Eastern Company's system at Drayton Park, and to explore the possibility of an extension of the Highgate Branch of the London Electric Railway to connect with the London and North-Eastern Railway at East Finchley.

The question of providing an interchange station between the Underground Railway and tramways and omnibuses at Golders Green Station has been referred to a Sub-Committee for further investigation.

The Committee has been impressed by the contention of the representatives of the Railway Companies and the Managements of the Tramway Undertakings that the main difficulty in the way of the provision of additional " through " facilities is the acute and wasteful competition between the various passenger transport agencies operating in the area. The proposals submitted by Mr. Frank Pick, on behalf of the Underground group of Railways and the London General Omnibus Company, for the establishment of a Common Management and a Common Fund, appear to the Committee to present a possible solution of the whole problem of London passenger transport, and it recommends that these proposals be carefully examined with the least possible delay.

The second report covers an area extending from Shoreditch and Hackney northwards to Waltham Holy Cross and to Loughton in the north-east, and from Stepney in the west to Brentwood in the east. This inquiry occupied seven days.

The Committee has come to the following conclusions:—

That the inadequacy of the through railway travelling facilities to and from East London generally has been established; more persons are seeking to travel in rush hours in and out of London than there are facilities to carry them. The very crowded and uncomfortable conditions are the main cause of the discontent which undoubtedly exists. The lack of efficient and rapid transit is retarding the development of the area, and it is clear that until existing steam railway lines are electrified, no material improvement can be secured in the existing railway facilities.

The Committee considers that the electrification of the steam railway lines in this area would afford the speediest means of providing a substantial improvement in the train services. Experience has shown that the capacity of a line can be increased from 100 to 200 per cent. by conversion from steam to electric working. The Ilford branch of the London and North-Eastern Railway if and when the work of electrification is put in hand should receive first consideration. The electrification of the Chingford and Loughton branch lines should also be given further consideration by the railway company.

The Committee recognises that the electrification of these lines and the improvement of the junctions would involve the railway company in heavy expenditure, but, on the other hand, it is common ground that this expenditure will require to be faced if the requirements of the travelling public are to be adequately met. The reluctance of the railway company to embark upon the work of electrification might be removed if it were assured that steps would be taken to ensure that the electrified lines would be protected from unnecessary competition.

With regard to the services provided by the Metropolitan District Railway between Barking and Central London, the London, Midland and Scottish Railway Company has commenced the work of improving the signalling arrangements upon the section of the line owned by it, in order to increase the capacity of that line. Every effort should be made to complete this work as soon as possible, so that the number of trains in the " peak " hours may be increased from 24 to 28 per hour, as contemplated by the Metropolitan District Railway. The projection of the District trains to Upminster would afford a very valuable facility to persons resident on the Becontree housing estate, and the London, Midland and Scottish Railway Company should give further consideration to this proposal. The provision by the London County Council of a rapidly increasing number of houses on the Becontree estate is creating a transport problem which is likely, in a very short time, to become even more urgent than that in respect of the districts served by the suburban lines of the London and North-Eastern Railway. Decisions as to the railway facilities to be provided should be reached before the building programme is further advanced to any extent.

With regard to the proposal that a new railway, partly underground and partly overground, should be constructed from Liverpool Street to Waltham Holy Cross, the Committee considers that the improvements referred to above should rank first in order of priority.

With regard to tramways, the provision of a connecting link between the Metropolitan Electric Tramways and those of the Walthamstow Urban District Council would enable very valuable through tramway services to be instituted between Walthamstow, Tottenham, Edmonton, and other places in North London, and the parties concerned should make another effort to overcome the difficulties which stand in the way of this much-needed improvement.

The evidence submitted by the representatives of the local authorities, particularly those owning tramway systems, as to the adverse effects of unnecessary omnibus competition with tramways, provides sufficient justification of the soundness of the policy adopted by the Committee with regard to the restriction of such uneconomic competition. No lasting solution of the London passenger transport problem can be secured so long as the present competitive methods are pursued. It is only by the elimination of all wasteful, uneconomic, and unnecessary competition between the various transport agencies, that it will be possible for any considerable improvements to be effected, particularly in the way of the construction of new underground or surface railways. The unified management of the local passenger transport agencies, *i.e.*, underground and other local railways, tramways, and omnibuses, would provide the only permanent solution of the whole problem of London passenger transport.

Legal.

Cooper v. Collins Electrical, Ltd.

THE Court of Appeal, consisting of the Master of the Rolls and Lords Justices Atkin and Lawrence, on December 1st dismissed an appeal by J. L. Cooper from the refusal of Judge Bairstow, K.C., at the Clerkenwell County Court to award him compensation under the Workmen's Compensation Acts against Collins Electrical, Ltd., of Clerkenwell Road, London, E.C. Cooper, on October 21st, 1925, whilst delivering a motor, slipped off a lorry and fell on his left hand, injuring two of his fingers. The respondents denied their liability to pay compensation for the accident after June 8th, 1926, on the ground that since on or before that date Cooper was not incapacitated for work as a result of the accident.

Their Lordships took this view, and, as before stated, dismissed Cooper's appeal.

Oriental Telephone and Electric Co., Ltd.

IN the Chancery Division, on November 30th, Mr. Justice Eve had before him a petition by the Oriental Telephone and Electric Co., Ltd., to confirm an alteration of the objects of the company.

Mr. GORDON BROWNE, for the company, said the proposed alteration was to give the company power to grant pensions and create pension funds for the benefit of its employés.

His LORDSHIP confirmed the alteration.

Consolidated Electrical Co.'s Appeal Dismissed.

ON November 30th the Lord Chancellor and Lords Atkinson, Shaw, Sumner, and Carson, in the House of Lords dismissed the appeal of the Consolidated Electrical Co., Ltd. (in liquidation) in its claim against the London Woollen Co. (also in liquidation) for repayment of a sum of £7,700 parted with in connection with the underwriting of a large number of shares, it was alleged, by misrepresentation. The Court of Appeal decided against the appellants on the ground of delay, a decision which now had the confirmation of the House of Lords.

The LORD CHANCELLOR said it would be impossible to allow the appeal without disturbing numerous decisions in which it was held that a person who claimed to rescind a contract to take shares on the ground that he was induced to do so by misrepresentation must be very prompt in taking proceedings, particularly because delay might be evidence of the affirmation of the contract, notwithstanding that misrepresentation had occurred, but partly because if delay happened, the company or third parties might be led to take action which they would not have taken if they had known that the shares were to be repudiated, or refrain from action which they would have taken if they had that knowledge. In the present case there had been delay, and, in his opinion, the appeal must fail. The other Law Lords agreeing, the appeal was dismissed.

Alleged Fraud.

AT Leeds Police Court, on November 30th, George F. Stirk, of Bradford, was remanded on a charge of obtaining by a trick 24 radio valves from the Mullard Wireless Service Co., Ltd., at Leeds, and was charged also with attempting to obtain a further 48 valves. It was stated that on November 27th Stirk telephoned to the Mullard Co. asking for two dozen valves, saying he had an account with their Manchester branch, and would send a man for the valves as he required them immediately. The valves were supplied. When another message was received on November 29th they did not send them as in the meantime they had ascertained that Stirk had no account with their Manchester branch.

Charge for Connecting-up Disputed.

THE *Western Mail* reports that at the Bridgend County Court, on November 30th, the Bridgend Urban District Council sued Mr. David Thomas, of Bridgend, for £4 13s. 9d., the cost of connecting his house to the electricity mains. Counsel for the plaintiffs said that the work was done in 1921, and the defendant had disputed the right of the Council to make a charge for it. He now, however, admitted that right, and had withdrawn a counter-claim. Mr. W. WELBURY, electrical engineer to the Council, gave evidence, and said that, if anything, the defendant had been charged less than his fair

share of the cost. They had originally sent in a bill for £9 4s. 5d., but had subsequently reduced it to the amount claimed. The plaintiffs' counsel said that his clients would consider any reasonable offer; the defendant thereupon offered £3, which was accepted. Judgment was entered accordingly.

Dublin-Lucan Electric Railway.

IN the High Court, Dublin, before Mr. Justice Johnson, last week, the matter of the Dublin-Lucan Electric Railway was mentioned for his Lordship's decision regarding an application for liberty for the Liquidator to enter into a contract for the sale of the undertaking to the Dublin United Tramways Co. for £12,500. Mr. Justice JOHNSON said he thought the agreement was quite a suitable one, and granted the application.

Reid v. Dalrymple.

IN the Glasgow Sheriff Court recently, Councillor W. Reid sued Mr. James Dalrymple, general manager of the Corporation Tramways, for £1,000 for alleged slander. The *Glasgow Evening News* states that Sheriff Blair having heard counsel and considered the case, sustained the defender's plea in law that the pursuer's averments were irrelevant and insufficient to support the conclusions of the initial writ. He accordingly dismissed the action, and found the pursuer liable to the defender in expenses. His Lordship had read two letters which contained the alleged slander, and his opinion was that there was nothing more in them than a statement that an apparent irregularity should be inquired into. On the question of privilege, there could not be, he thought, the slightest doubt that the defender, as manager of a great Corporation department, was privileged. Our contemporary says that it is informed that Councillor Reid has intimated his intention to appeal against the decision.

Boyce v. Morris Motors, Ltd.

THIS action, which was mentioned in our issue of November 19th, was taken by Mr. H. H. Boyce, who claimed an injunction restraining the defendants from infringing his letters patent for the Boyce "Motometer," the licensees for which in this country are the Benjamin Electric, Ltd. On December 4th Mr. Justice Astbury gave judgment in favour of the plaintiff, holding that the patent was valid. He granted the injunction asked for and an inquiry as to damages, and ordered the delivery-up or destruction of the infringing instruments, and gave the plaintiff the costs of the action.

A Canadian Appeal.

ON December 6th, before the Judicial Committee of the Privy Council, consisting of Viscount Haldane, and Lords Dunedin, Darling, and Warrington, an appeal was heard from a decision of the Quebec Appeal Courts. The proceedings arose out of an action by Messrs. Price Bros. & Co., Ltd., to restrain the respondents, La Corporation d'Energie de Montmagny and La Compagnie Electrique de Montmagny from supplying electric power in alleged breach of covenant in a deed of sale. In the original action judgment was given for the appellants, but it was reversed by the Quebec King's Bench (Appeal Side).

After hearing Counsel for both parties, their Lordships reserved judgment.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The Christmas Holidays.—Owing to the Christmas holidays our issue of December 24th will appear one day in advance of the usual time. Therefore it will be necessary for all editorial and advertising matter to be in our hands early. Our Advertisement Department notifies that alterations to existing Trade Advertisements should be received at 4, Ludgate Hill by Wednesday, December 15th, while 5 p.m. on Monday, December 20th, will be the latest time for the acceptance of Official Notices, Situations Vacant, &c.

The E.D.A.-E.L.M.A. Campaign.—The official report for the week ended December 4th states that new electric circles were formed at Ashford (chairman: Mr. Wilson) and Gravesend. Demonstration houses were opened at Huddersfield, Whitby, and Low Fell (Newcastle), and it was decided to keep the Lincoln house open for a further week. The houses at Paisley, Dundee, Leeds and Edinburgh have been well attended. Demonstration houses will be opened in all the principal towns during the next two months. Hull has decided to open a demonstration house in January. The Shropshire, Worcestershire and Staffordshire Electric Power Co. is continuing its series of small local exhibitions in its area. Exhibitions have been or will be run in Lichfield, West Hagley, Tewkesbury, Dudley, Evesham, Droitwich, Halesowen, and Ashford. A Liverpool firm reports increased business as the result of the displaying of the campaign lantern slide at local kinemas. Huddersfield has circulated 21,000 copies of a letter containing an invitation to inspect the demonstration house there. During the current week special campaign meetings were to be held at Leicester, Lichfield, Wolverhampton, and Nottingham. In the last town special cards are being displayed in the tramcars and omnibuses, and sign-banners have been erected to direct people to the demonstration house. With the report a copy of "Home Lighting News" No. 5 was received. This announces that 2,756,976 pieces of "literature" have been purchased for distribution by contractors and supply undertakings, and during the last few weeks nearly a thousand Press reports have drawn attention to various phases of the campaign. In addition, the campaign is being advertised in 1,251 shop windows, 156 model houses have been sold, and 261,000 cheque coupons have been circulated. This number contains illustrations and particulars of the special campaign Christmas window display.

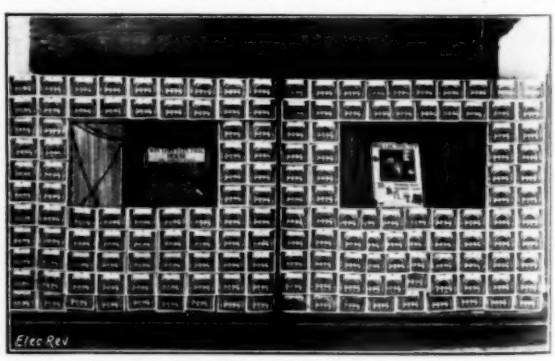
Mr. J. S. Kilpatrick, hon. secretary of the Paisley local committee, says that during its three weeks' run the Paisley demonstration house was visited by between 5,000 and 6,000 people. Another house, of the bungalow type, is to be fitted up early in the New Year.

Mr. G. H. Parry, in a recent lecture at Liverpool, said that over 186,000 people inspected the electric house recently on view on the St. George's Hall Plateau, Liverpool. The house did not cost the city a penny to build and equip, and the running expenses would be amply met by the increased demand for electrical appliances. The educational value of the house and its contents had been far reaching.

Birmingham claims a record in the matter of demonstration houses in connection with the campaign. Four of these houses were on view in the suburbs of the City until a few days ago, when two were closed, after a very successful period, during which the houses were visited by several thousands of people. There will be no demonstration houses open in the City during the Christmas season, but four more will be opened in January. They will be equipped and staffed by local contractors. The experience of the Birmingham Committee is that from three to four weeks is a sufficient period for a demonstration house to remain open, and it is not proposed, therefore, to keep any houses open longer than a month.

The competition is being well advertised by the Corporation Electricity Department, and it is reported that over 3,000 competition booklets have been distributed from the Dale End offices.

Row upon row of competition booklets recently arrested the attention of those who passed by the Blackburn Electricity



The Blackburn Showroom Window.

Department's showroom window. As our illustration shows, nobody could fail to inquire what the display was all about, and we are sure that Mr. P. P. Wheelwright's department was inundated with applications for the competition booklet.

The all-electric demonstration house, promoted by the Huddersfield Circle—representing all sections of the electricity industry locally—was opened to the public on November 29th, at Le Marchant Avenue, Marsh, by Mrs. Shires. The house is different from those in a good many towns in the fact that it is not a newly-erected one, the choice of an older house being made deliberately to show how easily electrical fittings can be applied to existing houses. The house will remain open until December 24th.

"Osram" Valves on Large Liners.—The GENERAL ELECTRIC CO., LTD., states that "Osram" valves are used in the radio installations of the Cunard liners *Berengaria*, *Aquitania*, and *Mauretania*.

Unemployment.—The Employment Exchange returns dated November 22nd recorded a total of 1,514,700 unemployed; this was 36,835 less than a week earlier, but 340,155 more than on November 23rd, 1925.

Social Events.—Mr. A. A. C. Swinton, F.R.S., the chairman of Messrs. Crompton & Co., Ltd., attended a meeting of the Tennis Section of Crompton's Athletic Club last week and presented prizes to the successful competitors—Miss Kilmartin, Miss Parsloe, Messrs. T. E. Wyrill, and W. G. Heath, and Major J. R. Watson, O.B.E.

The annual dinner of the staff of the Farnworth Municipal Electricity Works was held at the Railway Hotel, Farnworth, on December 1st. The chairman and engineer were present, and the menu was humorous and appropriate.

The annual whist drive and dance of the Paisley Corporation Electricity Department was held at the Town Hall, Paisley, on November 26th. Provost and Mrs. Crawford, Mr. and Mrs. F. H. Whysall (Greenock), ex-Bailie and Mrs. Balderston, and Mr. W. Blair Smith (the electrical engineer) and Mrs. Smith were among those present. Music was provided by the Arcadians Orchestra. Mrs. Crawford presented the prizes to the successful whist players.

The employés of the Fife Electric Power Co., Ltd., held a successful whist drive and dance at Dunfermline on December 3rd. The arrangements were made by a committee of which Mr. T. C. Hunter was secretary.

A whist drive and dance arranged by the staff of M. J. Dyson, electrical wholesaler, Bradford, was held on December 3rd at Sherwood House. Included in the company were many electrical men from Leeds, representatives of various manufacturers, and also Bradford contractors. Mr. A. J. Johnson (Siemens & English Electric Co., Ltd.) acted as M.C. for dancing, whilst Mr. W. Butler was M.C. for whist. Mr. Harry Moss (Bradford) presented the prizes. Mr. Arthur Jackson's Vauxhall Dance Band played for dancing.

Works Visit.—On November 25th a party of students from Faraday House visited the Stratford works of the HART ACCUMULATOR CO., LTD., where they inspected the various processes of manufacture of all types of batteries, from the initial stages in the foundry to the final stages of assembly and finishing. After tea, which was provided by the company, Mr. A. Regnauld expressed the party's thanks for the company's hospitality.

New Underground Railway Headquarters.—The design of the new building for the Underground Railway Companies in Broadway, Westminster, has been approved. The building will be about 100 ft. in height, and the estimated cost is £300,000. Work will commence shortly, and is expected to extend over a period of two years.

Leeds Council and Municipal Trading.—At a meeting of the Leeds City Council last week a proposal was considered and approved instructing the manager of the Electricity Department to report upon the question of the installation and sale of electrical appliances and fittings. An amendment to refer back the proposal was defeated. Sir Charles Wilson pointed out that a clause had been added to the Electricity (Supply) Bill giving all municipal authorities these powers, stipulating that such departments must be run in a commercial manner. Ald. Foster (chairman of the Electricity Committee) said that the Gas Department already possessed similar powers.

Commercial Electrical Travellers.—The Electrical Trades Commercial Travellers' Association held a successful dance at Victory House, Leicester Square, on December 3rd, about 200 members and friends being present. During the evening a cushion with a hand-painted design, the work of Mrs. Marks, wife of the chairman, was raffled, a sum of £3 5s. being obtained for the Association's benevolent fund. The winner was Mrs. Barnes. The music was provided by Mr. Tom Dally's band, and from the reception accorded it by the company, it was obviously much appreciated. The lighting effects, kindly provided by the Strand Electric and Engineering Co., contributed to the success of the evening, and the catering arrangements left nothing to be desired. The thanks of all present are due to Mr. Moir, hon. secretary, and those who assisted him in arranging the event, for a very pleasant evening.

Lead.—Messrs. James Forster & Co. report (December 4th):—"Arrivals of lead during November were not as large as generally anticipated, the total being about 20,000 tons, against 23,320 tons in October. Consumption, however, is now at its lowest ebb, and this explains why, with only moderate arrivals, there has been almost a glut of lead. With the coal strike virtually settled, we consider that the worst of the fall in prices has been seen, and look for a better demand for lead and lead products after the turn of the year."

For Sale.—Sleaford Urban District Council Electricity Department invites offers for surplus generating sets, switchboard, feed pumps, water heater, &c. The directors of the Great Northern Railway (Ireland) invite offers for surplus electrical apparatus, including generating sets, water-tube boilers, pumps, &c. (See our advertisement pages to-day.)

Czecho-Slovakian Machinery Importers.—The United States Consul-General at Prague reports that Czecho-Slovakian dealers in machinery are organising a special section of the Central Merchants' Association of Czecho-Slovakia with a view to protecting the interests of machinery dealers. As a large proportion of the machines and machine parts imported by Czecho-Slovakia are received from export houses in Berlin and Vienna, the Czecho-Slovakian merchants will endeavour to bring about the direct importation of machinery, or at least to restrict the re-exportation from other countries.

The Anglo-German Conference.—At the conclusion of the conference last week between representatives of the F.B.I. and the Reichsverband der Deutschen Industrie a general statement was issued emphasising the fact that the conference had not discussed the question of international combines. The matters dealt with were the general economic situation, which is to be further investigated, double taxation, interchange of information, and credit insurance. With regard to the last, it was agreed that nothing further could be done until after the conference of representatives of the European insurance companies, which is to take place in the near future.

North-Western Whitley Council Conference.—The annual conference of the electricity undertakers in the North-Western Area took place in Manchester on November 30th for the purpose of receiving the employers' reports upon the work of the District Council and the District Joint Board for the past year. The reports contained many items of special interest owing to difficulties experienced in consequence of the general strike. The reports indicated that the normal functions of the Council had been resumed with amicable feelings on both sides. The conference represented about 80 undertakings and about one-fifth of the electrical interests in the country. The chairman, Alderman T. E. Higham (Accrington) intimated, with regret, the resignation of Alderman H. Clark from the membership of the Council and Board, to which latter body he had rendered excellent service during the past five years. A resolution recording appreciation of Alderman Clark's services was adopted. The vacancy thus created was filled by the appointment of Councillor J. Hanson, the chairman of the Rochdale Electricity Committee.

Chinese Notes.—The Dah Wah Engineering Co. has been formed in Shanghai (287, North Chekiang Road) to undertake all kinds of electrical engineering work.

The municipal authorities of Canton have signed a contract with an American firm for the installation of 4,000 automatic telephones and switchboards at a cost of $700,000. The work will probably be completed in 18 months.

The Tientsin radio station has resumed communication with Mukden, Kalgan and Suiyan.

The South-Eastern Wireless Administration has been formed in Shanghai to control the services in the provinces of Kiangsu, Chekiang, Fukien, Kiangsi and Anhwei. At present it controls three stations, *viz.*, those at Woosung, Nanking and Foochow, but it is to formulate plans for further developments.

Australian Electricity Workers' Strike.—One thousand workers struck work last week at Yallourn. Supplies of brown coal ceased and the briquetting plant was closed down. It was stated that if the strike lasted, the electric power house would also have to close down, causing a serious shortage of electric power in Melbourne and some of the country districts.—*Reuter* (Melbourne).

The Cardiff Engineering Exhibition.—We regret that we inadvertently omitted to make reference to the stand of MESSRS. HOPKINSONS, LTD., in our description of the above exhibition in our last issue. Our omission was the more serious because the company's stand was one of the largest in the show, and bore a very comprehensive selection of steam fittings, including all types of valves, pipework, gauges, &c. A very effective exhibit was the means of illuminating water gauges electrically. Another section of the stand was devoted to signalling equipment for mines, electrically and mechanically operated. This was demonstrated upon the stand. Another feature of the exhibit was a large model of the company's Britannia Works, Huddersfield.

Lighting Trade Development.—Speaking at the annual meeting, on December 3rd, of Lighting Trades, Ltd., the chairman (Mr. H. J. Mitchell) said that they had considered it good policy to interest themselves in the sale of electrical fittings. They had therefore recently purchased the old-established business of J. & W. B. Smith, Ltd., and they were busy on its development, and confidently looked forward to its proving of material assistance to the company.

New Italian Companies.—Among the concerns recently formed in Italy in connection with the electrical industry are the Società Elettrovolta, Milan, capital 10,000 lire, to manufacture electrical glassware and apparatus; the Società Impresi Elettriche Meridionali Sarde Iglesias, capital 600,000 lire, to undertake the distribution of power in the Island of Sardinia; the Società Construzione Elettromeccaniche Ing. Giardini, Novara, capital 500,000 lire; the Società Industria Romana Pile Elettriche, Rome, capital 25,000 lire; the Società Elettrometallurgica, Novara, capital, 200,000 lire; the Società Officine Elettro-Meccaniche Scarpa e Magnano, Savona, capital 1,200,000 lire; the Società Applicazioni Brevetti Elettrotechnici, Rome, capital 100,000 lire; the Società Bordoni Imprese Elettriche Industriale, Turin, capital 30,000 lire; the Società Italiana Radiodina, Milan, capital 80,000 lire; and the Società Azienda Commerciale Radio del Vecchio, Milan, capital 50,000 lire.

Diary.—We have received a copy of Charles Letts's Engineer's Diary, containing a great deal of engineering data and tables compiled by Mr. J. E. Dodsworth, F.R.S.S.

Valve Propaganda.—The MULLARD WIRELESS SERVICE CO., LTD., is carrying out an intensive propaganda for the "pushing" of "Mullard" valves, and we have received copies of posters, &c., which are being employed.

Trade Announcements.—MESSRS. CHARLES SELZ are moving in January to new premises at 47-49, New Cavendish Street, W.1, where they are opening large showrooms. The firm has sent us a handsome paper-cutter bearing its name.

MR. W. H. STANGER, electrical engineer, has opened premises at 13, New Road, Spalding, Lincs.

MESSRS. YELDON & GARDINER, electrical engineers, have opened premises at 4, Reservoir View, Tavistock Road, Plymouth.

MESSRS. LONG & CRAWFORD, LTD., have reopened their London office at Bush Lane House, Bush Lane, Cannon Street, London, E.C.4 ('phone: "City 2753"), in charge of Mr. H. H. Leage.

Catalogues and Lists.—THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for November, containing a number of well-illustrated articles upon "Osram" lighting installations, valves, &c. Also two pamphlets advertising "Osram" valves and a leaflet dealing with the focusing of automobile lamps.

MR. J. S. WHITE, 6, Dowgate Hill, Cannon Street, E.C.4.—An illustrated and priced leaflet dealing with various patterns of electric master clocks and dials.

MESSRS. A. F. BULGIN & Co., 9-11, Cursitor Street, Chancery Lane, E.C.4.—A pocket containing illustrated price lists of radio accessories.

THE NORMAND ELECTRICAL CO., LTD., 3, North Side, Clapham Common, S.W.4.—A priced leaflet advertising heavy-duty geared motors.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—Folder No. 3,760, giving particulars and prices of "Elasta" lamps.

THE WHOLESALE FITTINGS CO., LTD., 23-27, Commercial Street, E.1.—Catalogue No. 190, containing illustrations and prices of "Supastone" glassware for lighting.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Two illustrated pamphlets dealing respectively with decoration lamp outfits and flashlight lamps. Priced.

HIGGS MOTORS, Witton, Birmingham.—December stock list of a.c. and d.c. motors.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—December blotter advertising the company's electric wash boiler.

MESSRS. BLACKSTONE & CO., LTD., Stamford.—Booklet No. 396, describing the company's 5-b.h.p. petrol engine, and Publication No. 374, dealing with oil-engine costs.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A coloured poster, a cardboard cut-out, and a descriptive folder advertising the company's new "DEP 215" valve.

MESSRS. ALLARDSTOWN & CO., 51, Westow Street, Upper Norwood, S.E.19.—A priced and illustrated pamphlet advertising "Spook" luminous switch covers and other luminous devices for indicating positions in the dark.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—December illustrated price list of electrical appliances and accessories.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.1.—List I.P. 1/26, dealing with "Selco" electrically-driven centrifugal pumps.

THE ENTERPRISE MANUFACTURING CO., LTD., Electric House, Grape Street, Shaftesbury Avenue, W.C.2.—List 89, containing particulars and prices of "Emaco" wireless cabinets; and List 90, a price list of cables and flexibles.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E.7.—A folder describing in some detail the company's new mining type draw-out switchgear.

BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—List 900 (56 pp.), containing particulars of the company's industrial lighting equipment with many illustrations of actual installations.

BRITISH ELECTRIC LAMPS, LTD., Spencer Hill Road, Wimbledon, S.W.19.—A price list of drawn-wire decorative automobile lamps, and a separate folder advertising "Maxtrip" tubular lamps.

EAST LONDON RUBBER CO., 29, Great Eastern Street, E.C.2.—A series of catalogue pages (illustrated and priced) to replace others in the company's list.

"M.K." ELECTRIC, LTD., Wakefield Street, Edmonton, N.18.—A pamphlet describing the company's multi-contact spring sockets.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—List No. 160, illustrating and describing "Unipivot" instruments for d.c. measurements.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A priced and illustrated pamphlet (No. L. 385) dealing with the "Pearl Mazda" internally-frosted lamp.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—December calendar-blotter advertising the company's shaker conveyors.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A folding advertising the company's small power control gear.

Bankruptcy Proceedings.—C. W. WATSON, electrical and wireless engineer, 33, Rainhall Road, Barnoldswick, Yorks.—First meeting held December 8th, at the Official Receiver's office, 12, Duke Street, Bradford. Public examination, December 20th, at the County Court, Bradford.

H. L. WOOD, electrical engineer, 7, Taswell Road, Southsea.—Last day for proofs for dividend, December 14th. Trustee, Mr. H. Ashton, Official Receiver, 87, High Street, Portsmouth.

E. F. WOODGATE, electrical engineer, 7, St. John's Terrace, and Brunswick Cottage, Weymouth.—First meeting held December 7th, at the Official Receiver's office, City Chambers, Catherine Street, Salisbury. Public examination, January 28th, at the County Hall, Dorchester.

R. P. REEVES (Lux-Ray Spotlight Projector Co.), electrician, 5, Say's Corner, North Quay, Great Yarmouth.—First meeting, December 11th, at the Official Receiver's offices, 9, Queen Street Chambers, Norwich. Public examination, December 20th, at the Town Hall, Great Yarmouth.

R. L. BROCK (R. L. Brock & Co.), electrical engineer, 5, Bedford Row, Tavistock Road, Plymouth. Trustee, Mr. J. S. B. Hole, Monument House, Monument Street, E.C., appointed November 30th.

W. K. M. WILSON, electrician and wireless apparatus dealer, 1, Mount Street, Heanor, Derby.—Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham, released November 23rd.

F. ANDERSON, electrical engineer, 109, Warwick Street, Greenheys, Manchester.—First meeting held December 7th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, December 17th, at the Court House, Manchester.

F. H. THOMAS, electrical engineer, carrying on business in co-partnership with W. E. Evans, at Salubrious Chambers, Salubrious Passage, Swansea, as Thomas & Evans. Application for discharge to be heard December 22nd, at the Town Hall, Swansea.

J. A. TREND, electrician, 31, Chapel Street, Luton.—First and final dividend of 10s. 3d. in the £, payable at the offices of Messrs. Keens, Shay, Keens & Co., 11, George Street West, Luton.

J. G. F. RENNIE, electrical engineer, 19, Bridge Street, Andover.—First and final dividend of 2s. 7¾d. in the £, payable at the Official Receiver's office, City Chambers, Catherine Street, Salisbury.

R. L. FOGGIN (Tithebarn Radio Co., Crosby Radio Co., and High Bridge Radio Co.), electrical engineer, Glen Avon, Fir Road, Waterloo, 63, Tithebarn Street, 75, Crosby Road N., Waterloo, Liverpool, and High Bridge, Newcastle-on-Tyne.—Trustee, Mr. E. D. Symond, Official Receiver, released November 22nd.

V. DE FRECE (lately trading with J. R. Hereford Lavey as the Radio Cash Stores), electrician, 371, Upper Street, Islington, N., 5, New Station Street, Leeds, and Parliament Street, Nottingham.—First and final dividend of 20s. in the £, payable at 78, New Oxford Street, W.

R. FENTON, 74, Park Road, Chesterfield, Derbyshire, late 514, Sheffield Road, Chesterfield, electrical engineer.—The first meeting of creditors was held on November 26th, at the Official Receiver's offices, Nottingham. The deficiency was returned at £316. Debtor attributed his failure to lack of capital and enforced sales under executions.

Company Liquidations.—ST. HELENS ELECTRIC LIGHTING CO., LTD.—Winding up voluntarily. Liquidator, Mr. C. H. Jones, Broad Sanctuary Chambers, Westminster, S.W. Meeting of creditors, December 14th, at the liquidator's offices. (This notice is formal; all creditors have been or will be paid in full.)

MANDA MOTORS, LTD.—Winding up voluntarily. Liquidator, Mr. A. H. Partridge, 3, Warwick Court, Gray's Inn, W.C.1. Meeting of creditors held December 7th at the offices of Messrs. Fincham, Partridge & Co., 3, Warwick Court, Gray's Inn, W.C. Particulars of claims to the liquidator by December 31st.

Dissolution of Partnership.—BRUN RADIO AND ENGINEERING CO. (formerly the D.S.F. Co.), electrical engineers and wireless experts, 88, Manchester Road, Burnley.—Mr. W. Dugdale and Mr. J. Foxcroft have dissolved partnership. Mr. Foxcroft will continue the business in his own name and on his own account.

German Foreign Electrical Trade.—The value of the imports of foreign electrical machinery and apparatus, not including carbons, carbon brushes, porcelain insulators and insulated wire, into Germany during the nine months ended with September last is returned at £904,650, as compared with £670,000 in the corresponding period of 1925. There was also a large increase during the same period in the exports of similar goods of German manufacture—from £11,580,050 to £12,747,600.

New French Companies.—Among the companies recently formed in France are the Société l'Electro-Transmission (26, Cours La Fayette, Lyons), capital 400,000 fr., to exploit patents relative to a new electric transmission system; La Compagnie Internationale des Appareils de Securité pour Chemins de Fer (20, Rue du Rempart St. Etienne, Toulouse), capital 300,000 fr., to acquire and exploit certain patents relating to electro-magnetic-pneumatic devices to secure safety and protection on railways; and La Société des Haut Parleurs Aclea (22, Place de la Madeleine), capital 200,000 fr., to manufacture a new type of loud speaker.

Argentine Meter Regulations.—A new series of regulations regarding the official approval of electricity meters in Argentina has recently been issued by the Argentine Government.

Unemployment in Germany.—According to the *Financial Times*, the number of persons in receipt of public support in Germany on November 15th was 1,314,000, an increase of 6,000 during the week.

Book Notices.—"The China Year Book, 1926-7" (1,334 pp., tables and map). Edited by H. G. W. Woodhead, C.B.E., Editor of the *Peking and Tientsin Times*. Tientsin: The Tientsin Press, Ltd. European agents: Simpkin, Marshall, Hamilton, Kent & Co., Ltd., London. Price 42s. net.—This cyclopædia of China and its affairs has again been brought up to date, and in view of the prominence of Chinese affairs at the present time is doubly useful. The preface to the work contains a brief history of the events which led up to the serious anti-foreign riots and boycott in 1925.

"The Whitworth Book." Prepared by the Whitworth Society: honorary editor, David Allan Low, M.I.Mech.E. Pp. vi+316; portrait of Sir Joseph Whitworth. London: Messrs. Longmans, Green & Co., Ltd. Price, 10s. 6d. net.—To all who are interested in any way in the past or present activities of the Whitworth Society or the scholarships this book offers all the information possible. A copy of the correspondence which passed between Sir Joseph and the Science and Art Department (now Board of Education) leading to the foundation of the scholarships is included, and, from that time up to the present day, the details of the progress made and the annual prize-winners are also shown. A complete list of all Whitworth men up to 1925 is given with, where obtainable, notes on their careers. The list contains 1,401 names, and is complete with the exception of the names of the exhibitioners appointed in 1869 only four of which have been found. Of the 1,401 men, 156 are known or reported to be deceased, and 185 are still unlocated. The last-mentioned are contained in a separate list.

"Annual Table of Constants and Numerical Data.—Electricity Magnetism and Electrochemistry." Extracted from Vol. V. Paris: Gauthier, Villars et Cie. Price, 77 fr. and 56 fr.

"Electric Trains." By R. E. Dickinson. Pp. xii+292; figs. 138. London: E. Arnold & Co. Price, 16s. net.

The "Practical Engineer" Electrical Pocket Book and Diary, 1927. London: Oxford University Press. Price, cloth, 2s. 6d.; pluvinsine, 3s. net.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland (Incorp.)." Vol. LXIX, 1925-26. Glasgow: The Institution.

The Australian Trade Commissioner Service.—In view of the forthcoming removal of the seat of the Commonwealth Government to Canberra it has been decided to transfer the headquarters of the Trade Commissioner service from Melbourne to Sydney, owing to the latter city's closer proximity to the new capital. Accordingly, as from February 1st next the address of the Senior Trade Commissioner in Australia (Mr. R. W. Dalton) will be: Herald Building, Pitt Street, Sydney. The address of the Melbourne Trade Commissioner will be: Henty House, Little Collins Street, Melbourne.

A Shop-Lighting Guarantee.—In a new folder, which is addressed to shopkeepers, the General Electric Co., Ltd., offers to prepare a lighting scheme, based on the "Gecoray" system, for any shop window free of charge. Moreover, it guarantees the reflectors for five years, and will replace any which check, peel or tarnish within that period.

Conditions in Austria.—A report upon the financial and commercial situation of Austria has been prepared by Mr. O. S. Philpotts, O.B.E., British Commercial Secretary at Vienna (Stationery Office, 1s. 6d. net). Mention is made of the improvement which followed the international control of State finances, rendering it unnecessary to utilise the whole of the League of Nations loan. A large proportion of this loan has been employed in the electrification of the railways. In the section dealing with foreign trade, Mr. Philpotts refers to the effect of water-power upon the coal imports. The report states that in most branches Austria is over-industrialised for its present needs. It is an exporter of many classes of engineering products, including electrical goods and telephone and telegraph apparatus, and competes with the United Kingdom in neighbouring markets. The proximity of countries employing the same language as Austria is a handicap to United Kingdom exporters and this country's share of the import trade is therefore small; it has, however, been increasing for some time. It is stated that the Austrian electrical machinery and equipment industries are doing well owing to the water-power works, the electrification of the railways and the extension of broadcasting, although the initial "boom" in the wireless trade came to an end early in 1925. In 1925, 19 water-power works were completed, yielding 63,000 mean h.p. and a possible 301 million kWh yearly. In 1926 it was expected that four works of 7,400 kW (62 million kWh) would be completed. In 1925 four works with a total of 43,000 h.p. and an annual output of 342 million kWh were commenced. 4,000 km. of h.p. lines has been completed since 1917. There is a scheme for the utilisation of the power of the Danube near Vienna by which 130 000 h.p. could be obtained; it appears that the undertaking depends upon the provision of a market for the energy. The electrification of the Arlberg line is now complete as far as Feldkirch, 158 km. from Innsbruck. It is expected that it will reach the Swiss frontier at Buchs and Bregenz by the beginning of 1927. Progress is also being made with the lines east of Innsbruck. The "Ravag" broadcasting company had two stations and two others were in project at the date of the report. The company's capital is owned mainly by the Federal Government, local authorities, and apparatus manufacturers. The standard of programmes is good and there is a certain demand for high-class British receiving apparatus, especially loud speakers. An appendix to the report gives the following information regarding Austrian exports:—Electrical machinery and glass lamps: 1924, 31,721,000 schillinge (United Kingdom, 2,360,000 schillinge); 1925, 29,132,000 sch. (United Kingdom, 2,213,000 sch.)—mainly supplied to Germany. Electrical apparatus and accessories: 1924, 33,538,000 sch. (United Kingdom, 2,259,000 sch.); 1925, 29,672,000 sch. (United Kingdom, 2,392,000 sch.)—mainly supplied to Czecho-Slovakia and Poland. The schilling=7¼d. approx.

Austrian Foreign Electrical Trade.—The following table, showing the value of the imports of electrical machinery and apparatus into Austria and the exports of similar material of Austrian manufacture during the past two years is compiled from a recent issue of *E.u.M. Zeitschrift des Elektrotechnischen Verein* of Vienna. The values are shown in thousands of gold crowns, and it will be seen that while imports increased there was a falling off in exports:—

	Imports.		*Exports.*	
	1925. In 1,000 gold crowns.	1924. In 1,000 gold crowns.	1925. In 1,000 gold crowns.	1924. In 1,000 gold crowns.
Dynamos, motors and transformers	4,740	4,912	7,762	11,369
L.p. apparatus: telephone and radio material ...	3,402	1,025	7,593	5,479
Electric meters and measuring instruments ...	1,744	1,073	1,307	2,337
H.p. apparatus	4,222	5,290	4,915	6,831
Electric lamps	2,441	4,143	12,850	11,094
Cables and insulated wires	417	203	4,422	6,107
Accumulators and plates	83	32	342	445
Electric carbons	887	472	787	389
Electrical insulating and fitting materials	2,193	1,072	555	52
Insulating tubing	85	205	301	1,126
Totals in thousands of gold crowns	26,214	18,427	40,834	45,229

A Pump Chart.—MESSRS. HATHORN, DAVEY & CO., LTD., Sun Foundry, Dewsbury Road, Leeds, have issued a useful chart by means of which the sizes of centrifugal and reciprocating pumps for various quantities and heads can be determined.

German Cable Orders.—The Reich Railway Company is reported to have placed orders of the value of several millions of marks for the supply of cable required in connection with the electrification of the Berlin city railway. Twelve cable-making firms are participating in the contracts.

H.P. Cable Contract for Southern Railway Extension.—November was a record month in the history of MESSRS. JOHNSON & PHILLIPS, LTD., with regard to the value of orders booked. In addition to large orders in relation to electricity supply schemes, they have received from the Southern Railway an order for the high-pressure cable in connection with the extended electrification of its system. The Railway Company has decided to extend its electrified suburban lines on the third rail system, using direct-current at 660 V, to Tattenham Corner, Caterham, Epsom Downs, *via* Streatham and Mitcham and also *via* Norwood and West Croydon. Power will be transmitted to sub-stations at 11,000 V working pressure by means of some 78 miles of 3-core paper-insulated, lead-covered and steel wire armoured cables manufactured and installed by Messrs. Johnson & Phillips. Under the Railway Company's programme, Messrs. Johnson & Phillips are required to have the sections to Tattenham Corner and Epsom Downs ready for the Derby Day in 1928, in order that an electric train service may be given to the race-course on that day.

Industry's Increasing Burden.—In a letter to the Prime Minister under this heading, the Federation of British Industries deals with the increased obligations upon manufacturers resulting from recent social legislation such as widows', orphans', and old-age pensions. Local taxation is also mentioned, as are a number of minor legislative measures which tend to hamper the conduct of business and impose burdens on industry and commerce. The Federation considers that the time has come when a halt should be called, and suggests that the Factories Bill should be postponed for a time.

Luminous Switch Covers.—MESSRS. ALLARDSTOWN & CO., 51, Westow Street, Upper Norwood, S.E.19, have produced a useful device for marking the position of a switch in the darkness. It is a glass cover which can be applied to any tumbler switch. Around the centre boss of this "Spook" cover are six equally-spaced luminous spots which give quite a bright glow. The firm also makes several other devices for non-electrical applications, such as luminous hand-signalling disks, house-name plates, and a crescent of luminous spots for fixing over a keyhole, &c.

Manufacturing in Norway.—As the share capital of the A.S. Elektrisk Bureau of Oslo is now considered to be larger than is needed it has been decided to reduce it from 6,000,000 kr. to 3 000.000 kr., bearer bonds for 3,000,000 kr. being issued at the same time. At a recent meeting it was stated that a foreign company had offered to acquire 49 per cent. of the capital, but as the directors stipulated that a dividend of 6 per cent. would have to be guaranteed for the remaining 51 per cent., the negotiations were broken off. The new cable factory will be set in operation in the near future.

Battery Manufacture in Ireland.—A manufacturer of batteries is now negotiating for the formation of a company in Dublin for the entire manufacture of these articles there, not alone for wireless, but for all other purposes. Wireless apparatus is being made in the Free State, and is being purchased in preference to imported makes.

The Machinery Users' Association.—The report which was presented at the annual meeting recently dealt largely with the provisions of the new Rating and Valuation Act which exempts machinery from rating. Reprints of articles upon this subject were circulated with the report. The accounts of the Association indicated a satisfactory financial position.

Peruvian Radio Apparatus Monopoly Cancelled.—The monopoly for the importation of radio apparatus into Peru, held for some time by the Peruvian Broadcasting Company, was cancelled by the Government in October. Importation is thus freed from restrictions, apart from a duty of 0.50 sol per kg.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. report, December 7th:—Copper (electrolytic) bars, £64 10s., 15s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £74 10s., 15s. dec.; ditto ditto h.c. wire, 9¼d., 1/16d. dec. Messrs. James & Shakespeare report, December 7th:—No change in prices of copper bars (best selected), sheet, and rod; English pig lead, £30 5s., 5s. dec. Messrs. Edward Till & Co. report, December 7th:—India rubber, Para fine, 1s. 5¼d., ¾d. dec.

Lighting and Power Notes.

Altrincham.—SPECIAL ORDER.—Application is being made by the Altrincham Electric Supply, Ltd., for a Special Order authorising it to extend its area of supply so as to include those parts of the urban district and the parish of Dunham Massey not already supplied by the company, and also in certian parishes in the rural district of Bucklow.

Amesbury.—OPPOSITION TO SCHEME.—The Rural District Council has decided to lodge an objection against the application of the Amesbury Electricity and General Supply Co. for an Order to suppiy electricity in the district, on the ground that it would be giving a monopoly to one company.

Western Australia.—YEAR'S WORKING.—We have received from Mr. W. H. Taylor, general manager of the Western Australian Government electricity supply undertaking (which gives bulk supplies to Perth and Fremantle), a copy of his report, together with the statement of accounts, for the year ended June 30th last. The revenue amounted to £202,037, as compared with £185,194 in the preceding year, and the working expenditure was £147,620, as against £133,805, leaving a gross profit of £54,417 (£51,389). After deducting interest there was a net profit of £12,877, as compared with a loss of £2,124 in 1924-25. The capital expenditure during the year was £15,914, making the total expended on the undertaking £880,042. This amount is exclusive of £105,394, representing expenditure in connection with the new 12,500-kW set, which was in course of erection at the end of the year. This set will increase the capacity of the power station to 32,000 kW. The sales of electrical energy increased from 44,112,861 to 49,974,049 kWh, and the maximum supply demanded from 12,400 to 13,500 kW. The average price obtained per kWh fell from .996d. to .965d.

Birmingham.—MAINS EXTENSIONS.—Important mains extensions are foreshadowed in a report of the Electric Supply Committee to the City Council, which is asked to give authority to an expenditure of £400,000 on general extensions of h.p. and l.p. mains. In January last the Council authorised an expenditure of £250,000 for that purpose, and the whole of that money has been disbursed. The following sums have been expended on mains during the past three years:—Year ended March, 1924, £196,912; March, 1926, £289,042; and the year ended March last, £357,870.

Blackburn.—ELECTRICITY EXTENSIONS.—The Town Council has authorised a loan of £105,000 for the following purposes: Services, £40,000; mains and sub-stations, £50,000; and domestic apparatus, £15 000. It was reported at a recent meeting of the Council that within seven months the expansion of business had largely exceeded the estimate for the full year, there being over 1,500 applications.

Bolton.—NEW PLANT.—The Electricity Committee has decided to install two additional boilers, complete with economisers, stokers, and auxiliaries, at Back-o'-th'-Bank generating station as part of the extension scheme previously approved by the Committee.

LOAN SANCTIONED.—Sanction has been received to a loan of £25,000 for sub-station equipment and transformer kiosks.

Continental.—BAVARIA.—According to the *Board of Trade Journal*, a recent report issued by the State Building Authority states that the development of water power in Bavaria has considerably increased since the close of the war. Including plant still under construction, there are about 11,600 water power stations, with a total capacity of some 934,000 h.p., in the country. The total capacity of the larger plants amounts to 745,000 h.p., of which 375,000 h.p. is for electric light and power for general purposes, 128,000 h.p. for the electric railways, 185,000 h.p. for the electro-chemical and electro-metallurgical industries, 28,000 h.p. for the textile industry, 25,000 h.p. for the paper and press industry, and 4,000 h.p. for other purposes. The water power already in use, together with that capable of development according to examinations so far made, has a total capacity of 1,100,000 kW. Of this, plant with a capacity of 770,000 kW has been already earmarked for general electrical services and railways, and 340,000 kW for industry. The water power now developed or under development comprises about one-quarter of the total available Bavarian water power.

ICELAND.—According to *Commerce Reports*, the Dansk islandsk Analgsselskab A.-S., of Copenhagen, and the Islands Kemiske Fabriker have obtained a concession for the exploitation of four waterfalls at Arnarfjord, and propose to erect plants for the production of nitric acid by the arc process. It is estimated that the four waterfalls will yield approximately 40,000 h.p.

NORWAY.—The A.E.G. of Berlin has recently supplied to the Norwegian Nitrate Co., of Tyssedal, Norway, five sets of 2,500-kW transformers to convert 12,500 V, 25-period a.c. to 300 V d.c. The machines are required to increase the power supply for the company's aluminium works, and are intended for continuous operation. They have been designed to withstand a continuous overload of 10 per cent. and an excess load of 25 per cent. for a period of two hours.

Cornwall.—ELECTRICITY SUPPLY.—The Cornwall Electric Power Co. is taking steps to provide for an increased supply of electricity throughout the tin-mining areas. A considerable addition to plant is contemplated at the Hayle generating station of the company, and the mains are being extended from Redruth to St. Agnes for the supply, primarily, of power to the Kitty group of mines.

Dover.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £3,000 for mains, and £1,240 for a voltage regulator and meter house.

Dundee.—EXTENSION OF SUPPLY.—Representatives from the Town Council of Monifieth recently met a Corporation subcommittee in connection with a proposal to extend the Corporation electricity supply to Monifieth, at a cost of £15,000. The Electricity Commissioners are being communicated with.

Eastbourne.—PROPOSED NEW RING MAIN.—The electrical engineer has reported to the Council that the enormous increase in the heating demand arising from the coal situation has resulted in a difficulty in maintaining adequate standard pressure of supply in the more distant portions of the town, and in order to reinforce the existing feeder cables for present and future demands, he is of the opinion that it is necessary to deal with the outlying portions of the area by means of an e.h.p. supply at 11,000 V. Step-up transformers for increasing the voltage would be installed at the electricity works and similar step-down transformers installed for the present at three main controlling sub-stations. This supply would then feed 30 sub-stations, and thus relieve the existing ordinary h.p. feeder cables now in use between the works and the sub-stations for use in other parts of the town. It is proposed that this 11,000-V main shall be of the "ring" type.

Edinburgh.—COST OF COAL DISPUTE.—The Corporation Electricity Department estimates that the increased cost of maintaining the city's electrical services during the coal dispute was £100,000.

Huddersfield.—BREAKDOWN.—The *Manchester Guardian* reports that a serious breakdown at the power station on November 28th caused considerable inconvenience. The tramway service was considerably reduced, and mills were asked to cut down their consumption of power to the minimum. Mr. J. W. Turner, the Corporation electrical engineer and manager, said the breakdown followed one of about a fortnight ago, and the combined effect was to interfere considerably with the service. He pointed out that the Council had asked for new plant 2½ years ago, anticipating such a breakdown. There had been very considerable delay on the part of the Electricity Commissioners, on account of the new Electricity Bill. The normal service was restored on November 30th.

Japan.—ELECTRICAL DEVELOPMENT.—According to *Eastern Engineering*, a hydro-electric power plant with a capacity of 2,000,000 kW, to be erected at a cost of y.200,000,000, on the Yalu river, is proposed by Mr. Tadasaburo Yamamoto and Mr. Takema Machino, adviser to Marshal Chang Tso-lin.

The construction of the 30,000-kW sub-station of the Toho Electric Power Co. at Nishi Piwajima, a suburb of Nagoya, is to be completed before 1927. Electricity supplied by the Daido, Ibi, Nagarawawa, and Nohi Electric Power Companies and by the Hayakawa Water Power Co., will be received here for distribution to other sub-stations.

Littleborough.—ELECTRICITY IN BULK.—The Urban District Council has approved a draft agreement for the supply by the Rochdale Corporation of electricity in bulk.

Liverpool.—NEW PLANT.—The Corporation Tramways and Electric Power and Lighting Committee has recommended the installation of an additional 25,000-kW turbo-alternator with auxiliaries, two cooling towers, switchgear, &c., at Lister Drive power station, at an estimated cost of £185,700.

Northampton.—OVERHEAD LINES.—The Northampton Electric Light and Power Co., Ltd., has been informed that the Ministry of Transport has granted its application for consent to erect overhead lines at Wolverton, New Bradwell and Stony Stratford.

Northern Ireland.—ARMAGH.—At a recent meeting of the Urban District Council a scheme, prepared by Mr. P. A. Spalding, electrical engineer, for supplying electricity to the city and the immediate surrounding district, was approved. It was also decided to make application for a Special Order to carry out the scheme, which is estimated to cost £12,500.

WHITEHEAD (CO. ANTRIM).—The new power station of the Northern Electrical Co. was recently formally inaugurated by the chairman of the Town Commissioners. Applications for a supply have been received from over 80 residents, and 50 street lamps have been erected. The company has appointed Mr. W. Greenfield resident engineer and manager of the undertaking.

Norwich.—LOANS.—The Electricity Committee has recommended to the Town Council that application be made for sanction to the borrowing of £19,000 for trunk mains to Wymondham, Wroxham, and North Walsham, and £4,500 for transformers and switchgear.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

DOVER.—An increase of 5 per cent.

WEST HAM.—Lighting: An increase of 10 per cent. Power, heating, cooking, theatres, &c.: An increase of 20 per cent. Public lighting: An increase of 15 per cent.

PERTH.—The recommendation of the Electricity Committee to increase the charges by 20 per cent. was rejected at a recent meeting of the Town Council, an increase of 10 per cent. being agreed to.

Reigate.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £12,000 for generating plant on account of an application for £18,000.

Salford.—ELECTRICITY CHARGES.—The Corporation Electricity Committee has decided to withdraw its proposal to increase the charges for electricity by ¼d. per kWh.

Southend-on-Sea.—INQUIRY.—An inquiry was held by Col. F. C. Ekin, chief inspector of the Electricity Commission, on November 30th and December 1st with regard to the manner in which the supply of electricity has been administered in the borough. A number of allegations were put forward by Mr. R. T. Baker for the Southend branch of the National Citizens' Union and the Westcliffe Ratepayers' Association, which included the working of the Diesel engines, irregular reading of meters, the contract system of supply to consumers, the output of electricity compared with the consumption of coal, and the improper allocation of accounts in connection with mains and services. Mr. J. W. Wright, of Gillingham, with whom the Corporation negotiated for the purchase of the Diesel engines, stated that the cost to the Corporation had been £5,000 for each engine; the price of similar sets now was £23,000. Mr. R. Birkett, borough electrical engineer, stated that the Diesel engines were necessary to meet the increasing demand and to bridge over the period until the new station was provided. The Disposal Board was prepared to accept £4 or £5 per b.h.p. The engines in question were 1,750 b.h.p., so that the purchase price from the Board would have been £7,000 or £8,750 for each engine. The engines, according to a list published by the Diesel Engine Users' Association, were second in the country from the point of view of efficiency. The cost of the generating stations was £26 10s. per kW. With regard to the energy generated, accurate monthly returns were made from meter readings, which were transferred to log books. After further evidence had been given, the inquiry was closed.

Turkey.—CONSTANTINOPLE.—In order to meet the increasing demand for electricity supply in the Constantinople district, the Société Turque d'Electricité has recently added a new 17,500-kW turbo-alternator to its Silighdar power station, bringing the capacity of the plant up to 45,500 kW. The company is now supplying electricity to 36,822 consumers, representing a load of 40,088 kW, an increase of 4,070 and 4,094 kW respectively during the twelve months. The sales of electrical energy during 1925 amounted to 38,878,547 kWh, as compared with 33,408,983 kWh in 1924.

Willesden.—YEAR'S WORKING.—The accounts of the Urban District Council's electricity undertaking (engineer: Mr. A. W. Blake) for the year ended March 31st last show a total revenue of £152,044, as compared with £133,678 in the preceding year. Working expenses, including the purchase of a bulk supply from the North Metropolitan Power Supply Co., Ltd., amounted to £107,835, as against £98,105, leaving a gross profit of £44,209 (£35,573), to which was added revenue from other sources, making a total of £45,094 available. Capital charges and special expenditure charged to revenue amounted to £43,543, and there was a net profit of £1,551, as compared with a surplus of £5,876 in 1924-25. The capital expenditure during the year amounted to £88,785, the chief item being £50,909 for mains and services. The sales of electrical energy increased from 15,109,106 to 17,328,529 kWh, and the maximum supply demanded from 8,330 to 9,780 kW. The average price obtained per kWh fell from 2.123d. to 2.106d.

Wimbledon.—NEW PLANT.—The Electricity Committee has recommended to the Borough Council the purchase of one 10,000/2,000-V, 750-kVA transformer and one 2,000/440-220-V, 200-kVA transformer, together with the necessary e.h.p. and h.p. switchgear, for installation at the New Malden substation, at an estimated cost of £1,050.

Tramway and Railway Notes.

Australia.—YEAR'S WORKING.—The report on the working of the Western Australian Government tramway undertaking which operates in Perth and its suburbs (general manager: Mr. W. H. Taylor) for the year ended June 30th last shows a total income of £286,707, and working expenditure of £240,953, leaving a gross profit of £45,754. The figures for the preceding year were: Income, £281,612; working expenses, £236,008; gross profit £45,604. Interest absorbed £45,155, and there was a net surplus of £599, as compared with £769 in the preceding year. The capital expenditure during the year was £17,612, bringing the total expended on the undertaking up to £949,929. The number of passengers carried increased from 28,894,525 to 29,599,785, and the car-mileage decreased from 3,040,505 to 3,010,253.

Blackpool.—NEW CARS.—The Corporation has decided to purchase seven new double-deck covered tramcars, of the saloon pattern, to replace vehicles which will be withdrawn from service.

Burnley.—TRAMWAY SCHEME DEFERRED.—As the construction of a new tramway in Brunshaw Road will mean an expenditure of over £2,000 to relay a water main which crosses the road at one point, the whole scheme has been deferred for the present.

London.—INSTALLATION OF PASSIMETERS.—By the New Year there will be 43 passimeter equipped stations on the Underground. The Temple and Holborn stations are now being converted, and are due to be opened as passimeter stations in about a fortnight's time followed by Clapham North, Blackfriars, Bond Street and Oval, which will be completed in December. Old Street, on the City Railway, is also on the list, and will be in service in the New Year. Of the others due for installation, Balham and Morden will be equipped as soon as the rest of the work on these two new stations is complete.

BALHAM STATION.—The Balham station on the new Morden underground railway extension was opened for traffic on December 6th, and the services between the Hampstead and city tubes have been improved.

Morecambe.—RAILWAY SUPPLY.—The Corporation Electricity Committee has agreed to adopt the principle of direct supply of electricity to the L.M. and S. Railway Co., for the purpose of working its railway between Morecambe, Heysham and Lancaster, following the lines upon which the Corporation of Lancaster has hitherto been negotiating with the company.

Scarborough.—PURCHASE SCHEME ABANDONED.—At a recent meeting of the Town Council it was decided not to purchase the local tramway undertaking, for which negotiations have been proceeding for some months past.

Southern Railway.—SPECIAL ORDER.—A Special Order confirmed by the Minister of Transport on November 18th, subject to approval by Parliament, authorises the London Electric Supply Corporation to supply electricity to the Southern Railway Company for purposes incidental to the working and lighting of the railways belonging to that company which have been converted to electrical operation.

Telegraph and Telephone Notes.

Australia.—"BEAM" RADIO-TELEGRAPHY.—A preliminary test of the "beam" transmitting apparatus has been highly successful, but no attempt has been made to send messages. The first signalling test to Britain will take place very soon, if not already commenced.

Argentina.—RADIO-TELEGRAPHY.—According to the *Review of the River Plate*, the company operating the service of wireless-telegraph communication with Europe recently entered into the enjoyment of several valuable extensions of privileges. On September 17th, the Government issued a decree authorising the "Compañia Radio-telegrafica Argentina Transradio Internacional" to establish communication with stations outside of the Republic at a greater distance than 1,000 kilometres from the Federal Capital. The original concession did not permit communication with any country conterminous with Argentina, but the new ruling only excludes communication with Uruguay. The original concession also only allowed communication with "fixed" stations, but the company may now communicate with shipping outside the 1,000-km. radius from Buenos Aires. The company is no longer restricted to the use of long waves, but may transmit on waves of any length subject to subsequent Government reservations of particular wave-lengths. Immediate advantage of the new privileges has been taken. A short-wave transmitter has been added to the Monte Grande station and is now operating. A direct service to Rio de Janeiro and Southern Brazil has been in operation for nearly two months, and the company is to institute a service to ships anywhere in the Atlantic.

Bulgaria.—NEW RADIO-TELEGRAPH STATION.—The Bulgarian Cabinet has authorised the Board of the Bulgarian Post Office to erect another wireless-telegraph station in the neighbourhood of Sofia. A credit of 15,000,000 leva has been set aside for the purpose, and the work will be carried out under an agreement to be arranged between the Post Office and a contractor.—*Reuter's Trade Service* (Sofia).

Egypt.—RADIO-TELEGRAPHY.—The Marconi Radio-Telegraph Co. of Egypt is being formed to take over the Abu Zabal wireless station, near Cairo, which was originally built as one of the links in the Imperial wireless "chain," and has been operated by the British Government from the time of its opening in May, 1922, until now. It was the link between the Leaneld station and that at Karachi. Now that the Rugby station has been built and the Imperial system changed, says *The Times*, the Egyptian station is no longer of importance to the Government, which has accordingly disposed of it to the Marconi Co. In addition to communicating with Karachi, this station communicated with Palestine, Iraq, and Abyssinia.

India.—RADIO-TELEGRAPH STATION REOPENED.—The Postmaster-General of Burma announces that the wireless station at Victoria Point, the extreme southern tip of the Province of Burma, was to be reopened on December 1st, 1926. The discontinuance of this station since February, 1925, has been severely felt by shipping in the Bay of Bengal, says *Commerce Reports*, which points out that there are no land telegraph or ocean cable lines between Rangoon and Victoria Point, and the wireless station is the only means of communication along that part of the Burma coast.

International Congress.—VOLTA CENTENARY.—In connection with the celebration of the first centenary of the death of Alessandro Volta, an International Congress on Telegraphy and Telephony will be organised at Como. Particulars can be obtained from the Italian Ministry of Communications (Istituto Superiore P.T.T.), Viale del Re 131, Rome.

Mexico.—TELEGRAPH REORGANISATION.—The Government has provided over $8,000,000 for the modernisation of the telegraph and radio-communication services.

Navigational Radio-Telephony.—CLYDE INSTALLATION.—The Clyde Lighthouses Trustees are to proceed with the installation of wireless-telephone apparatus on the Little Cumbrae to establish communication between the lighthouse on the island and Toward. The cost is estimated at under £700 and the annual expense at between £5 and £10. Instead of a continuous call-bell system, it is proposed to fit clocks to automatically switch in the call-bell every half hour, and with this arrangement it will be possible to make calls every half-hour, day or night.

Switzerland.—TELEGRAPH AND TELEPHONE SERVICES.—An official report lately issued shows that at the end of 1925 the length of the telegraph and telephone lines in operation in Switzerland was 19,296 miles, with a total conductor length of 567,364 miles. During the year 1,144,434 inland telegrams, 1,981,893 outgoing and 1,976,893 incoming foreign telegrams, and 1,200,219 transit messages were handled, the total of 6,303,266 showing an increase of 1.16 per cent. over 1924. The report shows that the telephone service is making greater progress than the telegraph in Switzerland. There are now nine first-class exchanges with 11 sub-exchanges, 53 second-class, and 1,015 rural exchanges in the country. At the end of the year automatic exchanges were in operation at Zurich-Limmat (3,000 connections), Zurich-Tiefenbrunnen (700), Lucerne-Emmenbrucke (200), Lausanne-Mezieres (70), and St. Gall-Winkeln (50). On an annual income of £2,140,292, the Swiss Telephone Department showed a net profit of £203,574, whereas there was a loss on the telegraph service of £145,252.

The Telephone Service.—NEW EXCHANGE.—The new common-battery manual exchange at Seven Kings was brought into use on December 2nd with a switchboard of the No. 10 type equipped for 1,380 subscribers', 90 junctions, and 11 operators' positions, made and installed by Siemens Bros. and Co., Ltd., Woolwich. The opening of this exchange will relieve congestion in the Ilford exchange, as existing subscribers in the Seven Kings area will be transferred to the new exchange. It will also facilitate the provision of telephone service to those prospective subscribers in Seven Kings who have been waiting some time for their telephones.

Radio Notes.

China.—HONG-KONG LEGISLATION.—Considerable interest has developed recently in Hong-Kong in broadcasting, and the Government has introduced a new Bill relating to wireless-telegraphy. It is intended to make the fee for a receiving set approximately $2.50 per year, and possibly a proportion of the fees would be paid to the broadcasting organisation.

Finland.—NEW STATION.—A plan for the erection of a broadcasting station has been worked out under the sponsorship of the Ministry of Communications, says *Commerce Reports*. The project involves a station of 25 kilowatts capacity, with a wave-length of 1,500 metres, and among the sites mentioned the towns of Lahtis and Tavatehus are prominent; it would probably take at least two years to prepare this station.

Turkey.—CONSTANTINOPLE STATION.—Constantinople is shortly to have a broadcasting company of its own, and considerable progress has been made with the organisation and technical preparations. The studio in the Central Telegraph Office in Stamboul is quite ready, but it has not yet been linked by wire with the broadcasting station at Osmanieh, ten miles outside the town; nor is the latter quite complete, although another fortnight should see the beginning of trial emissions. The local subscription is to be, roughly, one guinea per annum. The company is endeavouring to obtain simplification of the present regulations affecting the installation of wireless sets. At present one has to apply to Angora, and after giving evidence of probity and furnishing various guarantors one may obtain a permit in exchange for an undertaking that the set will be at the disposal of the Government if the latter requires to requisition it. There is apparently no difficulty about importing sets, on which a tax based on their weight only is payable.—*Reuter* (Constantinople).

United States.—AUTOMATIC TRANSMITTER CONTROL.—Automatic operation of one of its transmitters has been developed by the Schenectady station of the General Electric Company of America. The best supervised transmitter is liable at times to go wrong, and there is always the chance that a break will occur during an important programme. At WGY a daily inspection of the valves is made; the 50-kW transmitter, located about four miles from the control room and studio of the station, has fifty valves of one sort or another, and the failure of any one means a shut-down. Occasionally the cause of trouble is not immediately apparent, and at such times the spare 5-kW transmitter, located a quarter of a mile from the control room, may be automatically operated by an ingenious series of 15 relays, controlled over three lines between control room and transmitter. The control-room engineer throws a switch, which starts the nine machines supplying the various types of current to the transmitter. A second switch supplies low-plate voltage, and the attendant may then consult an indicating device in the control room to find out if the transmitter is functioning properly before he throws a third switch, which puts the transmitter on full power. There are interlocking relays which automatically control the flow of water used for cooling the power valves, and these relays will automatically shut down the set if any part fails to operate. The switch-over from one transmitter to the other can be made in 15 seconds. While automatic operation may be continued indefinitely, it is customary to assign an operator to the set as soon as possible after the switch-over has been made.

Wave-lengths.—MORE CHANGES.—Changes of some of the wave-lengths used by the British broadcasting stations were to be made on December 5th. They are the result of two weeks' operation since the international readjustment, and will have the effect of "breaking up the short-wave" stations. The stations affected and their old and new wave-lengths are as follows:—

Stations.	Old.	New
Belfast	326.1	306.1
Edinburgh	288.5	294.1
Liverpool	288.5	297
Bradford	294.1	254.2
Leeds	297	277.8
Nottingham	288.5	275.2
Sheffield	288.4	272.7
Plymouth	288.5	400
Bournemouth ...	306.1	326.1

It was expected that a number of low-power stations in this country could be operated satisfactorily on exactly the same wave-length. The theory has, however, not proved to be practical, for some of the stations are so close together geographically, that each is clearly audible only over a very small area indeed, and so the group of nine relay stations (all on 288.5 metres) has been broken up. Four stations are to remain on that wave-length; the other five will share non-exclusive wave-lengths with Continental stations. Three main stations are also affected, but the changes will not necessarily be any more permanent than those in the first big change.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—January 4th, 1927. P.M.G.'s Department. Bells and buzzers. (B.X. 2984.)*

January 18th, 1927. Switchboard cable. (B.X. 3013.)*

January 25th, 1927. Telephone transmitters and parts. (B.X. 3012.)*

Telephone receivers and associated parts. (B.X. 3041.)*

SYDNEY.—January 26th, 1927. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories (Spec. 1065). (A.X. 3810.)*

Belfast. — December 11th. Electricity Department. Penstocks for circulating-water channels and ducts at Harbour power station. (November 26th.)

Cardiff.—December 13th. Board of Guardians. Electric lighting installation at the Ely Lodge Institution. Specifications (45s.), Mr. R. Stephenson, clerk, Union offices, 11, Park Place, Cardiff.

Clayton-le-Moors.—The Urban District Council is inviting tenders for the installation of electric lighting at the Council offices.

Cleethorpes.—December 11th. Electricity Department. E.h.p. feeder and l.p. distributor cables, section pillars, and disconnecting boxes, transformers and switchgear equipment, and house services, including meters. (November 19th.)

Dublin.—December 14th. Commissioner of Public Works. Installation of electric lighting at the new military barracks, Limerick. Specifications (£1) from the Office of Public Works, Dublin.

East Ham.—January 1st. Tramways Department. 10 double-deck bogie tramcars complete, or bodies and top covers with assembly of material; motor equipment; controller equipment; maximum traction swing bolster bogie trucks, magnetic track and hand brake equipment. (See this issue.)

Egypt.—CAIRO.—January 10th, 1927. Ministry of Public Works Mechanical Department. Electrical generating plant for Giza. (B.X. 3079.)*

Fort William.—February 1st. North British Aluminium Co., Ltd. Water turbines (impulse type) and d.c. generators for the Lochaber water power scheme. (See this issue.)

Haddington.—December 11th. East Lothian Education Authority. Electric lighting of new infants' school at Tranent. Schedules from Messrs. R. & A. K. Smith, 44, Queen Street, Edinburgh.

India.—December 21st. India Store Department. 280 miles (approx.) 110,000-V overhead transmission line. (October 29th.)

January 4th, 1927. 264,650 (approx.) copper bonds for track rails. (November 26th.)

December 14th. 200,000 large double-shed porcelain insulators, 50,000 large pothead ditto; 5,000 yd. 40-wire armoured composite cable. (December 3rd.)

January 21st, 1927. Circulating-water pumps, screens, and pump-house equipment, including delivery and erection in India. (See this issue.)

February 4th, 1927. 11 complete traction sub-stations and track-sectioning cabin equipments, including delivery and erection in India. (See this issue.)

London.—LONDON COUNTY COUNCIL.—December 13th. Electrical installation at the Lomond Grove Elementary School, Camberwell, S.E. (approx. 122 wiring points). (December 3rd.)

ISLINGTON. — January 21st. Electricity Department. Twelve months' supply of electrical and engineers' stores, including cables, meters, electrical sundries, lamps, transformers, and cable terminal, service, network and fuse boxes, circuit breakers, &c. (See this issue.)

Manchester.—December 14th. Tramways Committee. Steel girder tramway rails. Specification and form, Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

January 3rd, 1927. Electricity Committee. 33,000-V, 420-V, and 240-V switchgear. (November 26th.)

Meltham (near Huddersfield).—December 31st. Wiring, fittings, &c., required in the electric lighting of the Parish Church. Particulars from Mr. W. R. Carter, secretary, Church Council, Birchfield, Meltham.

Middlesbrough.—December 13th. Corporation. Electric lamps for the Sanatorium and Tuberculosis Hospital and other institutions. Forms from the Town Clerk, Municipal Buildings.

New Zealand.—WELLINGTON.—January 4th, 1927. Public Works Department. Waikaremoana electric power scheme. Switchgear and transformers. (B.X. 2872.)* January 18th, 1927. Transmission line steel towers. (A.X. 3732.)* February 1st, 1927. Storage battery and booster. (B.X. 2937.)*

February 15th, 1927. Transformers for Waikato. (B.X. 2985.)*

Post and Telegraph Department. January 17th, 1927. Switchgear, cables, motor-generator sets, &c. (B.X. 3020.)*

January 19th, 1927. Electric bells and tumbler switches. (B.X. 3011.)*

January 31st, 1927. Government Railways. Electrical equipment for Otahuhu car and wagon workshops. (B.X. 3038.)*

February 14th, 1927. Switchgear, armoured cable and accessories, motor-generator sets, filament lamps and reflectors. (B.X. 3078.)*

Nottingham.—December 31st. Electricity Department. Two 30-in. electrically-driven pumps, one motor-driven twin booster, one 256-cell storage battery. (November 19th.)

Salford. — December 13th. Electricity Department. Paper-insulated lead-covered cable. Particulars from City Electrical Engineer.

Siam.—December 15th. Royal Siamese Post and Telegraph Department. Telephone and submarine cable. (B.X. 3026.)*

Southend-on-Sea.—December 20th. Electricity Department. 1,300 house-service meters. (See this issue.)

South Africa.—KEETMANSTROOP.—December 15th. Municipal Council. Material required for an electric lighting scheme. (B.X. 3007.)*

CAPE TOWN.—December 15th. Electricity Department. Oil-cooled transformers. (B.X. 3028.)*

December 30th. South African Railways. Switchgear, cables, and transformers. (B.X. 3040.)*

Sowerby.—December 11th. West Riding C.C. Education Committee. Electrician's work required in alterations at Sowerby Bridge Tuel Lane Council school. Specifications from Mr. A. Beilby, Education Office, Sowerby Bridge.

Sutton Coldfield.—December 14th. Electricity Department. One 1,000-kW steam turbine, with condensing plant, auxiliaries, and piping. (November 12th.)

Tralee (County Kerry).—Kerry County Council. Wiring installation for the new County Hall, Tralee, County Kerry; and two 6-kW, 220-V, d.c. generators, direct-coupled to heavy-oil engines; supply and erection of one storage battery of 126 cells of about 110-Ah capacity; supply and erection, and alternatively supply and delivery only, of one four-panelled switchboard. Messrs. McEntee & O'Kelly, consulting engineers, Dublin.

Uruguay.—MONTEVIDEO.—January 19th, 1927. State Electricity Supply Works. 100,500 metres of wires and cables. (B.X. 3042.)*

January 24th, 1927. L.p. cables, telephone cables, branch and terminal boxes. (B.X. 3064.)*

January 28th. 923,000 meters, outdoor wires and cables. (B.X. 3063.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Birmingham.—Electricity Department. The Corporation has sealed the following tenders:—

Surface condenser for Summer Lane.—G. & J. Weir, Ltd.
Piping at Nechells station.—Brightside Foundry and Engineering Co., Ltd.
Rotary convertor for Digbeth station, supervisory control gear for Small Heath, extensions to switchgear for Summer Lane generating station and various sub-stations, one high-pressure steam turbine.—British Thomson-Houston Co., Ltd.
Rotary convertors for Handsworth, Saltley and Shaftmoor Lane.—Mather and Platt, Ltd.
Ash-handling telpher plant for Princes generating station.—Herbert Morris, Ltd.
Two frequency changers for Greet sub-station, five rotary convertors for sub-stations, one 1,000-kW and one 500-kW automatic convertor equipments, two high-pressure steam turbines for Nechells.—General Electric Co., Ltd.
Automatic rotary convertor for Ward End.—Harland Engineering Co., Ltd.
Transformers.—British Electric Transformer Co., Ltd.; Ferranti, Ltd.
Overhead transmission lines.—British Insulated Cables, Ltd.
Four water-tube boilers and pulverised fuel equipment for Nechells station.—Mitchell Conveyor and Transporter Co., Ltd.

Burnley.—Corporation.

Two 100-kW steam-electric generating sets for the local gasworks.—Ashworth & Parker, Bury.

Eastbourne.—Electricity Committee. Accepted:—

Boiler, stoker, chimneys, and water-treatment plant:—

International Combustion Co.	£23,116
Babcock & Wilcox, Ltd.	19,179
Stirling Boiler Co., Ltd.	18,918
Vickers Boiler Co., Ltd. (Accepted.)	**18,915**
John Thompson Water Tube Boilers, Ltd.	14,763

Motor-'bus Committee. Accepted:—

Electrical equipment at new 'bus depôt (£498).—W. L. Moorton.

Cheltenham.—Electricity Committee. Accepted:—

Cables (year's contract).—British Insulated Cables, Ltd.
Meters (year's contract).—Metropolitan-Vickers Electrical Co., Ltd.

Forden.—Board of Guardians. Accepted:—

Installing electric lighting at the Institution (£790).—Smallwood & Co., Shrewsbury. Eight tenders were received, the highest being £1,329.

Hornsey.—Electricity Committee. Recommended:—

Cables.—Contract extension for one year at existing prices.—Standard Telephones & Cables, Ltd.

Lamp Contracts.—The Great Western Railway Co. has placed contracts for 12-months' supplies of gasfilled electric lamps with Siemens & English Electric Lamp Co., Ltd., the British Thomson-Houston Co., Ltd., and Metro-Vick Supplies, Ltd.

London.—WAR OFFICE.

Batteries.—Edison Swan Electric Co., Ltd.

Marsden (Yorks.).—Urban District Council. Accepted:—

Wiring for electric lighting of 46 houses, Woods Avenue.—Mr. Thomas Firth.

Plymouth.—Tramways Committee. Accepted:—

15 tramcar trucks and electrical equipment, without erection (exclusive of brake equipment) (£12,967).—English Electric Co., Ltd.

Wimbledon.—Electricity Committee. Accepted:—

Feed-water heater (£170).—Holden & Brooke.

Forthcoming Events.

Physical Society of London.—Friday, December 10th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary scientific meeting.

Junior Institution of Engineers.—Friday, December 10th. 39, Victoria Street, S.W. 7.30 p.m. "A Method of Measuring Temperatures in the Cylinders of Internal-combustion Engines." Mr. C. E. Foster.

December 17th. "Progress Methods Employed in a Large Mass-production Motor Works." Mr. H. D. Glover.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, December 11th. Durham. "The Operation of Electrical Protective Devices." Mr. D. A. Murphy.

(London Branch).—Tuesday, December 14th. Junior Institution of Engineers, S.W. 6.30 p.m. "The Rotary Convertor." Mr. G. B. Alvey.

Society of Engineers.—Monday, December 13th. Burlington House, W. 5.45 p.m. "The Economic Proportions, and the Stresses in a Solid Masonry Dam or Buttress, Subjected to Water Pressure Acting on an Inclined Face." Prof. F. H. Hummel.

Institution of Civil Engineers.—Tuesday, December 14th London, S.W. 6 p.m. "Remodelling of Charing Cross and Cannon Street Stations." Mr. G. Ellson.

Institute of Marine Engineers.—Tuesday, December 14th. London, E. 6.30 p.m. Presidential address by the Rt. Hon. Lord Kylsant.

Royal Institution.—Tuesday, December 14th. 5.15 p.m. "The Imperfect Crystallisation of Common Things." Sir William Bragg.

Electrical Society of Glasgow.—Thursday, December 16th. 30, Gordon Street, Glasgow. 7.30 p.m. "Notes from the Diary of an Electricity Salesman." Mr. G. H. Rowbottom.

Edinburgh Electrical Society.—Thursday, December 16th. 117, George Street. 8 p.m. "Stationary Batteries for Home Lighting." Mr. A. Yates.

Paisley Association of Electrical Engineers.—Thursday, December 16th. Town Hall, Paisley. 7.30 p.m. "Home Lighting Campaign." Mr. W. Blair Smith.

Institution of Electrical Engineers.—Thursday, December 16th. London. 6 p.m. "Notes on the 60,000-V Underground Network of the Union d'Electricité." Col. E. Mercier.

(Mersey and North Wales (Liverpool) Centre).—Monday, December 13th. University, Liverpool. 7 p.m. "The Making of a Radio Valve." Messrs. H. W. Edmundson and G. B. Robertson.

(North-Eastern Centre).—Monday, December 13th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(North-Midland Centre).—Tuesday, December 14th. Hotel Metropole, Leeds. 7 p.m. Ordinary meeting.

(North-Western Centre).—Tuesday, December 14th. Engineers' Club, Manchester. 7 p.m. Ordinary meeting.

(Scottish Centre).—Tuesday, December 14th. Royal Technical College, Glasgow. 7.30 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(Sheffield Sub-Centre).—Wednesday, December 15th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Electric Locomotive Drive." Mr. G. H. Fletcher.

(London Students' Section).—Friday, December 10th. "Automatic Telephony." Mr. F. I. Ray.
Monday, December 13th. Institution of Mechanical Engineers, London. 7 p.m. "Payment by Results." Mr. E. H. Lewis.

(North-Western Students' Section).—Saturday, December 18th. University Women's Union, Manchester. 7 to 11 p.m. Dance.

Institution of Welding Engineers.—Thursday, December 16th. Caxton Hall, S.W. 8 p.m. "Some Features in the Path of a Crack." Mr. G. H. Gulliver.

British Electrical Development Association.—Friday, December 17th. Royal Society of Arts, London, W.C. 7.30 p.m. "Secrets of the Selling Art." Mr. G. S. Francis.

Birmingham Electric Club.—Friday, December 17th. Grand Hotel, Birmingham. 7 p.m. Annual meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

DRURY warning tile for H.T. cables.
TERRY toasters.
A fuse reel holder of flat metal holding three fuse reels.

Notes.

The Electricity (Supply) Bill.—On Tuesday last the Report stage of the Bill was taken in the House of Lords, and was concluded without material alteration to the Bill. The next stage is to be taken to-day

Ex-British Westinghouse Association.—We have received from the above Association copies of the annual membership book, 1926, and the current issue of "Inter Nos," Vol. 2, No. 2. The committee and dinner chairmen for the present year are Messrs. J. G. Wilson and O. H. Baldwin. The next annual dinner will be held at the Hotel Cecil on March 11th, when Mr. L. R. Morshead will preside.

Illumination Investigations.—A joint report of the Industrial Fatigue Research Board and the Illumination Research Committee, "The Relation Between Illumination and Efficiency in Fine Work (Typesetting by Hand)," has just been issued (H.M. Stationery Office, price 6d. net). It deals with investigations which have been carried out with the object of determining the optimum value of illumination for use in the composing rooms of printing offices. Definite conclusions are drawn and guiding principles are laid down, and many interesting data which were collected are given in the report. In addition to measuring the output of the experimental subjects, a careful record was made of the number of their mistakes, so that the qualitative as well as the quantitative, effect of various values of illumination could be determined. A separate record was made of the number of turned letters set; this is said to afford one of the best indications of the adequacy of illumination, as the presence of turned letters is mainly due to the compositor's inability to see the "nicks" in the type. In order to provide a standard for comparison, a daylight test was made, and the rate of output during this experiment has been regarded as the normal from which the efficiency of the several values of artificial illumination tried has been calculated. During two-thirds of the daylight-test periods the illumination varied between 100 and 250 ft.-candles, with a mean of 160 ft.-candles. The values of artificial illumination ranged from 1.3 to 24.5 ft.-candles, and at the latter value the rate of output and the ratio of total errors to output reached the daylight value. The percentage of turned letters steadily diminished as the illumination was increased, and closely approached the normal at 24.5 ft.-candles. These results are so consistent that they justify the definite conclusion that the optimum value of illumination for hand-composing lies between 15 and 25 ft.-candles. In one test daylight lamps were used and an output increase of 3 per cent. was noticed.

Electrical Association for Women.—On November 23rd, Mr. R. C. Hawkins gave a lecture to the members of the Manchester District Branch of the Association on "Lighting in the Home" at the Lighting Service Bureau, where demonstrations were given of the effect of different types of lighting, taking successively each different room in a house. The first luncheon of the Glasgow and District Branch of the Association was held at the Grosvenor Restaurant, Glasgow, on November 29th, when Lady Paxton, vice-president of the Branch, took the chair. Lady Cowan, vice-president of the London Executive, referred to the cheapness of electricity supply in Canada, and Mr. R. B. Mitchell, manager of Glasgow Electricity Department, outlined the easy-payment terms adopted for electrical installations by the Corporation, and explained that in Glasgow at the present time they had a system of payment extending over three years, but the Electricity Committee was considering the advisability of extending the period over ten years, so that the quarterly instalments would be very small and would make it possible for the very poorest class to have the advantages of electricity.

Thermionic Valve Impedance.—A recent Physical Society of London paper entitled "The Input Impedances of Thermionic Valves at Low Frequencies," by Mr. L. Hartshorn, A.R.C.S., B.Sc., D.I.C., of the National Physical Laboratory, shows that accurate measurements of input admittance (or of input impedance) under various conditions can be made by means of the Schering capacity bridge. The input circuit is regarded as being equivalent to a condenser with a definite phase angle, ϕ, or "loss angle," $\delta = 90° - \phi$, and the results are expressed by stating the effective capacity and value of tan δ for each set of experimental conditions. A series of measurements made on an "R" valve is recorded, and it is shown that the results are in good agreement with the theoretical investigations of Miller and Nichols. The theoretical investigation has been extended to allow for the effect of dielectric losses in the valve, since these were found by experiment to be rather large, and to have an appreciable effect on the capacity and phase angle of the input circuit. It is shown that the effective capacity may vary from about 10$\mu\mu$F. to 100$\mu\mu$F. for an "R" valve, and the phase angle may vary from about 80 deg. leading to 126 deg. leading, depending mainly on the load in the anode circuit. Values of phase angle greater than 90 deg. correspond to a negative resistance, or negative power factor, and occur when the load in the anode circuit is inductive. The variations of input capacity and phase angle with filament voltage, anode voltage, input voltage, and frequency are also investigated. In the discussion it was pointed out that the paper had an important bearing on a subject not mentioned in it—namely, the behaviour of valve voltmeters. It now appeared that variations in the load impedance of the valve had important effects on the effective input conductance, and might render this negative, so that the reaction on the measured circuit might be important.

Economy in Gas Manufacture.—At the "autumn meeting" of the Institution of Fuel Technology on Tuesday last, Mr. T. Hardie, M.Inst.C.E., in a paper on modern practice in gas manufacture, discussed the improvements that had been made in recent years in the thermal efficiency of gas works. The waste gases leave the retort settings at a temperature up to 1,000 deg. C., and contain energy equal to 50 or 60 per cent. of that evolved by the combustion of the coke used in the gas producers. Formerly about half of this energy was lost, but the recovery of the heat by means of specially designed waste-heat boilers is now common practice, from 600 to 1,500 lb. of steam being generated per ton of coal carbonised. At the Gas Light and Coke Co.'s Bow Common station 42 per cent. of the heat supplied to the producers is thus recovered in the form of steam, setting free large quantities of coke breeze which can be utilised by electricity works. With 83 waste-heat boilers at work shortly, 4,000 tons of steam will be produced per day, releasing for sale 600-700 tons of fuel. Gas engines cannot compete with steam thus cheaply obtained, and consequently the use of large steam turbines of high efficiency is receiving consideration, from which electric power will be transmitted to all points of the works.

Manchester Steam Users' Association.—In the memorandum by the chief engineer of the above Association, Mr. C. E. Stromeyer, O.B.E., for the year 1925, is contained an account of investigations which have been carried out on the question of failures of steel plates. From chemical analyses it was discovered that many failed steels contained relatively high percentages of nitrogen, and corroborative evidence has been obtained in cases in which no other cause of failure has been found but nitrogen. Mr. Stromeyer also discovered that caustic solution in contact with steel when under strain causes

brittleness and a number of failures are recorded which are claimed to be unquestionably due to this cause. The possibility suggested itself that some failures which were thought to be due to phosphorus or nitrogen, or to both elements, might really be due to caustic, and cases are recorded where the trouble is suspected to have been due to caustic; practically all old boiler cases have been placed under this heading for the following reasons. If carbonate of soda is introduced into feed water it converts the sulphates of lime and magnesia into carbonates of lime, the newly created sulphate of soda remaining in solution. However, if soda is introduced in excess, it enters the boiler as such, and at the high temperatures of high-pressure steam it loses its carbonic acid, as lime loses it in calcining kilns, and the boiler water is steadily enriched with caustic soda. This enrichment may be fairly rapid, especially in water-tube boilers. An interesting case confirms the above views: a large number of rivet heads on the fireboxes of an installation of Galloway boilers had fallen off; after the cessation of caustic soda treatment to the feed water the trouble came to an end. The inquiry has been set on foot as to what is the maximum percentage of caustic soda which is permissible in a boiler, but it will take years before an answer can be given. The publication also records experimental work which has been carried out on the provision, on steam pipes which pass from reducing valves to low-pressure vessels, of large safety valves, exceeding in some cases the sectional area of the pipes they serve by 100 per cent. It is concluded that a safety valve fitted beyond the reducing valve is not a safeguard against failure of the reducing valve, and that there is no advantage in making the safety valve of the same size as, or larger than, the pipe; also, placing the safety valve so that the escaping steam blows direct on to it is of no advantage. The report also contains accounts of a number of investigations on boiler sediments.

The Extra-High-Pressure Conference, 1927.—The next Extra-High-Pressure Conference will be held at Paris from June 23rd to July 2nd, 1927; it will therefore not clash with the summer visit of the Institution of Electrical Engineers to Newcastle, which is fixed for June 14th-17th.

Electro-Endosmosis.—A paper recently presented before the Physical Society of London by Mr. H. C. Hepburn, B.Sc., a research student at Birkbeck College, was entitled "Electro-Endosmosis and Electrolytic Water Transport." It gave the results of determinations of liquid transport produced by passing an electric current through aqueous solutions of copper sulphate divided perpendicular to the flow of electricity by a diaphragm of powdered glass. It was pointed out during the discussion that, in effect, the author measures the difference between the pressures on the two sides of his apparatus. As regards the statement that the water transport per faraday is proportional to the dilution, proportionality would seem to imply that with pure water the rate would become infinite. In addition to the two causes of water transport mentioned by the author, another possible factor was an action analogous to that which takes place in the Wehnelt interruptor, the rapid opening and closing of a capillary orifice by a bubble, when the current density is high, being capable of producing liquid transport. The author's apparatus might form a useful model for the study of certain insulators, such as vulcanised fibre, which are much used in industry, but behave when wet like solutions with low ionic mobility, and exhibit the phenomenon of water transport to a serious extent. It has been shown by Evershed that when such a dielectric is mounted between charged electrodes from which it is separated by layers of cable paper, electric charges accumulate on the sides of the paper adjacent to the dielectric and can be taken off with the paper; this phenomenon corresponds with the charging of the diaphragm discussed by the author. A further industrial problem connected with the subject is the tendency of linseed paint to peel off, when wet, from an electrically-charged surface. This behaviour must be ascribed to the water transport which takes place through the film of oxidised linseed oil, the transport being in the same direction as the current in an alkaline medium, but reversible by acidulation. The author, in reply, said that if the water circuit was interrupted so as to stop the transport, the pressure difference rose until equilibrium was reached, when the transport ceased. The proportionality between dilution and liquid transport failed for concentrations below .005 normal.

Fuel Economy Institutions Amalgamate.—At the inaugural dinner of the Institution of Fuel Technology, which was held at the Hotel Cecil, London, on December 7th, under the presidency of Sir Alfred Mond, Bt., M.P., it was announced that an arrangement had been made for the amalgamation of the Institution of Fuel Technology and the Institution of Fuel Economy Engineers, both of which bodies have similar objectives, differing only in their methods of approach.

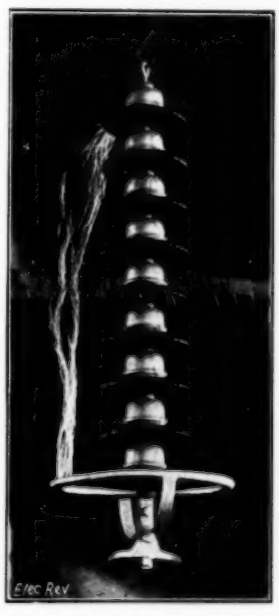
The Flow of Gases in Furnaces.—A Russian engineer, Prof. W. E. Groum-Grjimailo, read a paper on December 8th before the Institution of Fuel Technology, on the laws of gas flow in furnaces. He applied to this subject the laws of hydraulics, and developed a theory according to which a furnace should be so arranged that the flame enters it under positive pressure, the function of the chimney stack being only to remove the cooled products of combustion and on no account to influence the flow of primary or secondary air, or of flame, into the furnace. He concludes that furnaces should be constructed on the down-draught principle, and the pressure inside should approach zero; the flame should be forced into the furnace, and the waste gases drawn out. Many examples of industrial furnaces were illustrated. The theory may prove to be applicable also to the construction of boiler furnaces for use with gas or pulverised fuel.

Meters Sensitive to Music.—Users of gas will be exceedingly interested in a statement made recently by Mr. J. H. Canning, engineer and manager of the Newport Gas Co., at a meeting in Cardiff. He said that "certain tones in music affect the gases, when the meter is working, to a very marked degree," causing expansion. Even the back-firing of a gas engine, or the slamming of doors, might have some effect on correct registration, and he assured his hearers that in some cases it did so. We have heard of consumers having to pay for gas "to a pretty tune," but that, perhaps, is irrelevant; metrical expression, on the other hand, is the essence of poetry, and it might be worth while to recite a few verses in the cellar occasionally.

Generators to be Hydrogen Cooled.—Two large electric generators, each nominally rated at 90,000 kW at 90 per cent. power factor, which are being manufactured by the General Electric Company of America for the Southern California Edison Company, incorporate some unusual features of design. The armatures are being built with a very heavy construction so as to be gas-tight, with a view to the possible future adoption of a new system of hydrogen cooling. The machines are also the first to combine a double-flow low-pressure end and four vertical condensers, with advantages of a simplified foundation and increased space for removal of condenser tubes.

Lamp Standard Illumination. — Some comments of *The Motor* on recent automobile street accidents emphasise the necessity for the illumination or indication of street lamp standards. The Embankment (London) affords numerous instances of dangerous standards. Motor vehicles are frequently in collision with them. The trouble is that the light, seen a little distance away, appears to mingle with other lights in the distance, while the post itself and the island on which it stands are in the shadow cast by the lower part of the lamp. A simple remedy adopted in a few thoroughfares and some other cities is to indicate the presence of the post by a pair of red lamps facing the traffic. It is suggested that the Ministry of Transport should act in the matter and adopt a standard type of warning lamp, placed at a height of, say, 6 or 7 ft. from the ground on all central posts carrying street-lighting lamps.

A Suspension Insulator Under Test.—The rapid development of Italian water-power, which necessitates the use of long high-pressure transmission lines, has naturally resulted in the establishment of the manufacture of porcelain insulators in Italy, and last year new works were erected for this purpose at Leghorn by the S.A. Fabbrica Isolatori Livorno, where a limited number of types, ranging from small telegraph and telephone insulators to 80,000-V pin insulators, and suspension insulators for still higher voltages are made on mass-production lines. The accompanying illustration, for which we are indebted to Messrs. Wm. Geipel & Co., the British agents for the makers, shows a nine-element F.I.L. suspension insulator arcing over (dry) at 440,000 volts; this type is fitted with a single guard ring at the lower end. The length of the chain is 1,161 mm., and the operating voltage 150 kV, the working load being 1,500 kg. In some cases a top ring is also provided, or horns above and a ring below. Many thousands of these or similar insulators have been supplied by the makers to Italian power companies for pressures up to 150,000 volts.



F.I.L. Insulator Arcing Over at 440,000 V.

Railway Signalling.—In a paper on "The Organisation of a Railway Signalling Department," which was recently read by Mr. R. Falshaw Morkill before the Institute of Transport, the author outlined briefly what is being done in other countries rather than at home, particularly in the cases of Canada, the United States, Australia, and New Zealand. A railway-signalling organisation does not cause much inconvenience until the introduction of the modern methods of signalling, power, track circuiting, and automatic. In new countries

and on new railways the tendency has been to keep everything that appertains to signalling under the signal engineer, or to combine the duties of the signal engineer and telegraph superintendent. The railway electrical engineer is also concerned, being the medium through which electrical energy is furnished for power signalling, but there should be no duplication of responsibilities in his direction. On the Canadian Pacific Railway the system is divided into two districts, east and west, and a signal engineer for each acts as an advisory officer and prepares plans and estimates for new works. The actual maintenance work is the responsibility of signal supervisors. The signalling staff has no jurisdiction over the telegraphs and telephones, or over the lighting of the stations or yards.

On the Pennsylvania, U.S.A., Railway, the system is organised on a divisional basis. There is a chief signal engineer and a general superintendent of telegraphs for the system, but the regional signalling officers have also charge of the telegraphs and telephones. In the case of the Queensland Government Railway, the signal engineer is responsible for the general policy of signalling, station, and yard lighting, and for new constructional works. On the New Zealand railways a signal and electrical engineer is responsible for the telegraphs and telephones, electric power and lighting, as well as the signalling.

Appointments Vacant.—Assistant district engineer (£630) for the Singapore Municipal Commissioners Electricity Department. Armature winder for the Rawtenstall Corporation Tramways. Meter tester and repairer for the Aberdare Urban District Council Electricity and Tramways Department. Mains engineer for the Calcutta Electric Supply Corporation (Rs. 640 monthly+). (See our advertisement pages to-day.)

Exhibition of the Physical Society and the Optical Society.—This exhibition, which is to be held on Tuesday, Wednesday, and Thursday, January 4th, 5th and 6th, 1927, at the Imperial College of Science and Technology, South Kensington, will be open in the afternoon from 3 to 6 p.m., and in the evening from 7 to 10 p.m.

On January 4th, at 8 p.m., Prof. E. N. da C. Andrade will reproduce with contemporary apparatus a physical lecture of the early eighteenth century. On January 5th, at 8 p.m., Dr. C. V. Drysdale will give a lecture on "Progress in Electrical Instrument Design and Construction," and on January 6th, at 8 p.m., Mr. J. L. Baird will give a lecture on "Television." These lectures will be illustrated by lantern slides and experiments. Some 70 firms will exhibit scientific apparatus, and in addition there will be a group of non-commercial exhibits by Fellows of the societies and others, including demonstrations of famous historical experiments in physics, recent research and effective lecture experiments.

The exhibition will be open to the general public without tickets on the third day, January 6th. On January 4th and 5th tickets of admission will be required.

Invitations relating to January 4th and 5th have been given to the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Chemical Society, the Radio Society of Great Britain, the Röntgen Society, the Faraday Society, and other scientific societies. Members of such societies should apply for tickets to the secretary of the Society to which they belong. Others interested should apply direct to Professor A. O. Rankine, Imperial College of Science and Technology, South Kensington, S.W.7.

The Advantages of Decimal Reform.—While the campaign for the adoption of decimal coinage is gaining increased support, Sir Richard Gregory, in his presidential address to the members of the Decimal Association last week, stated that there was still need of extensive propaganda in order to impress the Government. In support of the Association's programme, it was stated that great retailers were becoming keenly alive to the advantages of the proposal of ten pence to the shilling. One large firm has calculated that the ability to use ordinary calculating machines would enable it to effect an economy of many thousand pounds a year, and the head of another firm has stated that decimal coinage would mean an economy of £2,000 per annum in a single department of his business.

The need for a change to metric weights and measures is also urgent if the United States (practically the only nation besides the British Commonwealths which has not carried out this reform) is not to be allowed to lead the way.

Gas v. Electricity.—The respective merits of gas and electricity were discussed at a conference of the Association of Gas Salesmen held at Darlington on Wednesday last under the chairmanship of Mr. G. Parker, Hull. The representatives were welcomed by Councillor Seaton Leng, formerly chairman of the Darlington Electricity Committee, who expressed the opinion that, although the uses of electricity were being constantly extended, there would always be a wide field for gas. Presenting a paper on "Electricity Competition," Mr. J. R. Hepple, Newcastle, referred to the impetus which the Electricity (Supply) Bill would give to the sale of electricity, and urged that the competition should be met with the most strenuous opposition. Owing to the present method of building houses eight or twelve to the acre, the cost of providing gas supplies was such that few, if any, gas undertakings found it a commercial proposition, while electrical companies were usually prepared to supply cables to the houses. The position might be met to some extent by allowing a fixed amount per pipe to the builder. He claimed that in the home the advantage lay with gas. The capital cost for fitting a five-roomed house with electricity was £50 12s. 6d., including the contribution towards the cost of laying the main cables, while the cost for installing gas at a similar house was £24 9s. 9d., including mains and services. If they could show householders that gas was cheaper than electricity for cooking and heating, they need have no fear of the future.

Lectures.—The first of a series of free public lectures to be given at Glasgow University this winter was delivered by Prof. E. Taylor Jones, whose subject was "Electrical Oscillations." The professor reviewed the history of the development of knowledge of electrical oscillations from the date when Lord Kelvin first announced his discovery of these oscillations to the Royal Philosophical Society of Glasgow. He explained the work of Kelvin and other scientists, including Hertz and Marconi, and illustrated the descriptions by lantern slides and numerous experiments with contrivances of ingenious construction. By this means he showed low-frequency and high-frequency oscillations, and with the oscillograph demonstrated the wave-form of electrical oscillations. In conclusion, the lecturer described the Baird model televisor, and referred to the modern problem of atomic oscillations and atomic structure.

Mr. J. L. H. Cooper, the officer of the Midlands Branch of the Lighting Service Bureau, gave a lecture on the lighting of industrial and commercial buildings and shop window lighting to the Walsall and District Building Trades Council recently. He emphasised the psychological value of electric lighting in shop window displays, and said it was essential, if the fullest value of electric lighting was to be obtained, that the shop window designer and the illuminating engineer should work in close co-operation. Dealing with the use of electricity in the lighting of factories and workshops, the lecturer said it contributed greatly to increased production, while it minimised accidents and enhanced the well-being of the employés.

New American Station.—The last public act of Queen Marie of Rumania in the United States, before concluding her recent tour, was to officially open, on November 23rd, the new East River Station of the New York Edison Company, which is designed for an ultimate capacity of more than a million horse-power. The Queen started up the first generating unit of the station, a 100,000-h.p. turbo-generator.

Aerials and Lightning.—In view of the article on "Lightning Discharges," by Mr. T. C. Gilbert, in our issue of November 26th, p. 870, the following note from the December issue of *Electrical Merchandising* is of interest:—The question frequently arises in connection with lightning discharges, as to the effect of the presence of a radio antenna on a building. The Department of Gas and Electricity of the City of Chicago has had this question under investigation for the past three years, and this investigation has indicated that the average receiving antenna does not increase or decrease the lightning hazard. Inspections of over one hundred cases where lightning had struck buildings showed only five cases where there were radio aerials on the buildings struck, or on adjacent buildings, and in these five instances there were no indications that the presence of the aerial wires on or near the building was in any way the cause of lightning striking the same. The following is a case in which an aerial wire did carry a part of the lightning discharge into a building with unusual results. During this storm, four buildings within a mile radius were struck, and in one instance the chimney of a two-storey brick building was hit. Attached to this chimney was a single wire receiving antenna about 40 ft. long, and a part of the discharge current entered the second apartment by way of the lead-in wire. The current jumped from the aerial lead-in wire to the ground wire at the receiving set where these wires were about one and one-half inches apart and did not enter the radio receiver. The ground wire was disconnected from a lead pipe in the bathroom, and the end of this wire was lying on the tile floor about six inches from the lead pipe. The gap between the end of the wire and the lead pipe was also bridged by the current. A hole about one-quarter of an inch in diameter was burned in the lead pipe and a stream of water spurted out, resulting in considerable damage to both the first and second apartments.

Manchester Electrical Engineers' Dance.—The second dance of the series of three to which all good electrical engineers go was held at the Midland Hotel, Manchester, on Friday last, December 3rd. There is, or perhaps was, a pathetic belief which may still have some currency in the immediate suburbs of Manchester, that what Lancashire thinks to-day, England will think to-morrow. Whether this be the case or not, it is still certain that Manchester, in the way of dances of a kind in which electrical engineers may reasonably take part, has a method which is entirely her own. Those who venture as far north as Birmingham may care to note that in Manchester dinner is served at 9.15 p.m. after the first three dances, the general view being, as the hon. secretary so ably expressed it, "You have got to get 'em lively."

During dinner a small cabaret show, or rather dancing exhibition, is given, and after dinner the dance itself begins in earnest. With the aid of a most excellent band, the two hundred-odd guests enjoyed themselves thoroughly, and it seems quite clear that the Manchester dance is now fully established as a yearly event to be looked forward to. As we have so often said, a delightful evening of this kind is only possible through the unselfish and painstaking work of a few

individuals, and we feel sure that on this occasion we only voice the feelings of all those present in saying that Mr. G. H. Fawcus, Mr. J. Harcourt-Williams, and their executive colleagues may heartily congratulate themselves on the eminently satisfactory result of their labours.

Institution Notes.

Institution of Electrical Engineers.—EXAMINATIONS.—The list of successful candidates for the Associate membership examination, held in October last, shows that 27 passed the whole examination, while five passed Part I and seven passed Part II. The results of the examinations held abroad will be published later.

SCOTTISH CENTRE.—The annual dinner of the Scottish Centre was held in the Grosvenor, Glasgow, on November 30th, and was attended by a large gathering representative of the electrical industry, as well as by ladies. Mr. Wilfrid L. Winning, chairman of the Centre, was in the chair.

Mr. John Craig, president of the West of Scotland Iron and Steel Institute, proposed the toast of the "Corporation of Glasgow." As an industrial people, he said, they were not very keen that the Corporation should become a great trading organisation. Now that the municipality had touched electricity, however, he suggested that one of its great functions was the organisation of the Electricity Department to make it possible for the industries of Glasgow to develop and to take their place in the world's competition.

Lord Provost Mason, who responded, remarked that the Corporation, as a manufacturer and supplier of electrical energy, had a deep interest in the Institution. They might claim to have done something in their day to promote investigation and research and to contribute to the progress of the transmission and distribution of electricity.

Sir John Gilmour, Bart., Secretary for Scotland, gave the toast of the evening—"The Institution of Electrical Engineers." Referring to the Electricity (Supply) Bill, he confessed that he was one of those who agreed that Governments would do well not to interfere with the ordinary channels of trade and commerce. But there might be, and he believed there were, times when the judicious use of the power of Parliament might direct and mould policy, and leave development to the great industries concerned. Referring to the electrical industry as one of the greatest movements of the age, Sir John declared that the responsibility which lay on their shoulders, and more particularly upon a great Institution like theirs, was a responsibility to see that they left no stone unturned to develop that power and to give the benefit of its use to generations not only of to-day, but those to come. Compared with the other great peoples, in spite of all our learning and progress, we were far behind in the development of electrical power. They hoped to see the use of it extended and a reduction accomplished in the number of stations from something like 600 small ones to-day to 60 great ones in the future. He was certain that if they could do something to cheapen electricity appreciably, to bring it into the homes of the people and into the great industries, and to electrify their railways, they were going to do something which would clean and purify the air and remove many of the anxieties which pressed on the minds of the great local authorities such as Glasgow, which affected the health and housing of the people, and which brought in their train the evils of disease. As an agriculturist and as one interested in the further development of agriculture, he visualised possibilities in the future not only of bringing electrical power into their great cities, but also of extending it into the country districts and bringing within the bounds of possibility its use on the farm for the production of food, and even in the lowliest cottage. They were determined that the possibilities this fresh legislation held out to them should not be lost.

Dr. W. H. Eccles, president of the Institution of Electrical Engineers, said, in reply, that he thought the passing of the Electricity (Supply) Bill would bring great prosperity to electrical engineers, especially a body of professional engineers like themselves, and the expansion of consumption which it would provoke most certainly would call for a great many more professional engineers than there were at present.

Professor Magnus Maclean proposed a vote of thanks to the chairman, Mr. Wilfrid L. Winning.

The Royal Society.—ATMOSPHERIC ELECTRICITY.—The extent to which magnetic storms and weather vagaries which so often accompany sunspots, are induced by the projection into the atmosphere of matter, was among the fascinating theories discussed by Sir Ernest Rutherford, the president, in his anniversary address to the members of the Society on the occasion of the annual meeting at Burlington House. The president referred to the striking advances which had been made in radio-communication, and to the new avenues of research into the electrical state of the atmosphere that were opened up by the study of the mode of propagation of wireless waves over the earth. Sir Ernest observed that while the study was of much interest in itself, the observations now being made by the Radio Research Board of the Department of Scientific and Industrial Research, and others, were of even more value as giving to scientists a new and powerful method of attacking the problem of the electrical state of the atmosphere, particularly at heights where direct observations were impossible.

"We may anticipate," he added, "that an extension of such experiments will provide us with much valuable information not only on the degree of ionisation of the upper atmosphere, but on its diurnal and seasonal variations. Although only preliminary observations have so far been made on this question, the results obtained show that there is much promise in this new method of attack on a difficult problem. The phenomena of the aurora and the diurnal variation of the earth's magnetism have long been supposed to indicate that the upper atmosphere is highly ionised and an excellent conductor of electricity. The origin of the ionisation is a matter of much interest. Part, no doubt, is due to the ultra-violet light emitted by the sun, but there may be other important contributory causes. During this year, Mr. E. A. Milne has shown how certain atoms of matter, ejected from the sun, notably those of calcium, may, in consequence of absorption and emission of radiation, acquire sufficiently high velocities to penetrate deeply into our atmosphere. It may be that the brilliant auroræ and magnetic storms which so often accompany sunspot activity, are a consequence of the projection into our atmosphere not only of electrons, as has long been supposed, but of swiftly moving atoms of matter."

MEDALS.—The president presented the Society's medals as follows:—

Copley Medal to Sir Frederick Hopkins.
Rumford Medal to Sir Arthur Schuster.
A Royal Medal to Sir William Hardy.
A Royal Medal to Professor A. V. Hill.
Davy Medal to Sir James Walker.
Darwin Medal to Dr. D. H. Scott.
Hughes Medal to Admiral Sir Henry Jackson.

DINNER.—The anniversary dinner was held at the Hotel Cecil, when Sir Ernest said that at the summer meeting in Brussels of the International Research Council it was unanimously agreed to invite the Central Powers to join that Council. They had thus removed the last barrier to scientific co-operation between the nations.

Diesel Engine Users' Association.—VISIT TO KING'S COLLEGE HOSPITAL.—The members of the Association, at the suggestion of their president, Mr. E. W. Johnston, lately visited King's College Hospital, at Denmark Hill, London. The installation of three Diesel engines has been in operation since 1913. The service of light, power, and various forms of electrical treatment in the hospital requires an output of about half a million kWh per annum, and a feature of the installation is the very high overall thermal efficiency of about 75 per cent. which is obtained, due to the utilisation of the whole of the waste heat from the Diesel engines in connection with the hospital hot-water supply and for preheating the air supplied to the boilers which provide steam for general heating purposes. The refrigerating plant serves the cold storage and produces the ice which is required in the hospital at the rate of about 15 cwt. per day during the summer months. Beyond the engine room, workshops, and stores of the Works Department, which deals with the whole of the engineering plant, electro-medical and surgical apparatus, the attention of the visitors was drawn to many features of special interest, such as the equipment of the X-ray and Electro-Therapeutics Departments, including various forms of light treatment, special forms of lighting in the operating theatres, &c.

Junior Institution of Engineers.—PRESIDENTIAL ADDRESS.—In his address to the Institution on December 3rd, Engineer Vice-Admiral Sir Robert Dixon reviewed the recent progress of marine engineering, with particular reference to naval practice, thereby continuing the narrative commenced by one of his predecessors, Sir Henry Oram, in his presidential address to the Institution in 1909. In his conclusions he indicated existing problems which arise whether developments are intended for naval or commercial work.

Royal Institution.—At a general meeting on December 6th, the special thanks of the members were returned to Mr. Frank Scudder for his gift of a crystal model, nine lantern slides used by Sir Henry Roscoe in his lectures on Faraday, and a Franklin Medal in aluminium which belonged to Faraday; and to the Department of Scientific and Industrial Research for the gift of the whole of the apparatus used by Sir William Bragg in his researches on the X-ray analysis of crystals.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

On Friday evening last Prof. THOMAS TURNER was presented with his photograph, a volume of signatures, and a motor-car by past and present students, colleagues and friends, on his retirement from the Chair of Metallurgy in the University of Birmingham. The presentation was made by Mr. Neville Chamberlain, M.P. (Minister of Health), who forty years ago was a student under Prof. Turner at Mason College.

Mr. CHARLES TRICKER, who has completed 38 years in the electrical department of the Port of London Authority at

Victoria Dock, E., was on December 1st presented by his colleagues with a gold watch.

When the Wigan Corporation appointed Mr. G. A. HOPKINS as tramway manager twelve months ago, it was agreed that the appointment should be reconsidered at the end of one year. At last week's Council meeting it was reported that the position had been carefully reviewed, and Mr. Hopkins was appointed tramway general manager at £600 per annum.

Mr. W. CALLANAN has been appointed teacher of electrical engineering at the Cork Municipal Technical Schools.

Eastern Engineering reports that Mr. W. J. WILLIAMS, municipal electrical engineer at Penang, has been appointed head of the newly-constituted Electrical Department of the Federated Malay States, which commences operation on January 1st. Mr. Williams has been at Penang for six years, and was formerly with the Shanghai undertaking for nine years.

Alderman Mrs. HAMMER has been appointed chairman of the Hackney Electricity Committee. She is believed to be the first woman to occupy such a position in this country.

At last week's meeting of the Burma Electric Supply Co., Ltd., reference was made to the fact that the secretary, Mr. W. R. ELSTON, had served the company for 25 years, and it was resolved to make a presentation to him as a mark of the shareholders' esteem.

It is stated that Mr. J. DALRYMPLE, whose resignation of the tramway managership at Glasgow has been reported, has been retained to advise on the transport system of a city in South America at a fee of 1,000 guineas per month for three months. He will sail on January 14th.

Mr. A. B. CLEWORTH has joined the Premier Cooler and Engineering Co., Ltd., London and Shalford, to take charge of the sales of humidifying and ventilating plant.

MESSRS. CHARLES F. DURANT and FRED L. WILLITTS have voluntarily resigned their positions as manager and engineer respectively with Messrs. Robinson & Hands Electrical Co., Ltd., the former after 18 years' and the latter 7 years' service, in order to commence business as wholesale distributors early in the New Year at Tudor House, Livery Street, Birmingham.

On Tuesday evening last, at the Hotel Russell, the staff of W. T. Henley's Telegraph Works Co., Ltd., held a very largely attended Bohemian concert, at which a presentation was made to Sir GEORGE SUTTON, Bart., to mark his retirement from the active managing directorship of the company. The presentation was made by Mr. W. J. Potter, who had been longer associated with Sir George than anybody else connected with the company. Sir George, who will retain the chairmanship, in responding, delivered an interesting speech, in the course of which he intimated his intention to celebrate the occasion by transferring to the Works Benevolent Fund for the benefit of the workpeople 1,250 of his ordinary shares in Henley's company, the present market value of which was about £5,000. We shall refer to the proceedings more fully next week.

Obituary.—MR. ALEX. B. ROBERTSON, SENR.—Mr. Alex. B. Robertson, Senr., of Aberdeen, founder and chairman of Messrs. A. B. Robertson & Son, Ltd., plumbers and electrical engineers, recently died suddenly at the age of 74. Mr. Robertson had been in business in Aberdeen for 47 years, and he and his firm carried out a large number of important electrical engineering contracts. Mr. Robertson served for 23 years on the Aberdeen Town Council.

MR. W. C. OWEN.—The death took place on November 27th, at Bath, of Mr. W. C. Owen, who spent 40 years in the telephone service. He was 62 years of age. In 1882 he entered the service of the United Telephone Co. and he spent many years with the telephone companies and the Post Office. In 1902 he commenced business as an electrical contractor, but in 1904 he re-joined the service of the National Telephone Co. He was the author of a book dealing with telephone lines and methods of construction published in 1903.

New Companies Registered.

Price & Reef, Ltd. (217,809).—Private company. Registered November 27th. Capital, £100 in £1 shares. Objects:—To carry on the business of electrical, mechanical, and general engineers, manufacturers, importers, exporters, factors and brokers of, and dealers in wireless detectors and valves, radio, and electrical instruments and apparatus, &c., and to effect the beneficial operation or realisation of certain patents taken out or applied for by S. L. Price in respect of (1) improvements relating to thermionic devices (being a non-filament valve); (2) a wireless crystal detector or valve; and (3) a multi-filament valve. The first directors are:—S. L. Price, 185, King's Avenue, Clapham Park, S.W.12, electrical engineer; J. R. Reef, 28, High Street, Wallingford, Berks., wholesale electrical factor (both permanent governing directors). Secretary: J. R. Reef. Solicitors: Tredgolds, 71, Lincoln's Inn Fields, W.C.2. Registered office: 71, Lincoln's Inn Fields, W.C.2.

John Hunter & Co. (Heating), Ltd. (217,824).—Private company. Registered November 27th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of heating and ventilating engineers, &c. The permanent directors are:—S. A. MacLeish, "Berydene," St. Agnes Road, Huyton, Lancs., electrical engineer; R. A. Harrison-Watson, "Wemba," Mount Pleasant, Birkenhead, electrical engineer. Qualification, 1 share. Solicitors: Louis E. Menzies & Co., 51, North John Street, Liverpool. Registered office: 25, Roscoe Street, Liverpool.

V. Badman, Ltd. (217,806).—Private company. Registered November 27th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of, and wholesale and retail dealers in wireless in all its branches, valves, radio, and radio-active instruments, &c. The permanent directors are:—V. Badman, 88, Western Road, Southall, Middlesex; Mrs. S. A. Badman, 88, Western Road, Southall, Middlesex. Qualification, 1 ordinary share. Solicitors: E. J. Garner, 118, High Street, Uxbridge.

E. O. Walker & Co., Ltd. (217,745).—Private company. Registered November 25th. Capital, £3,000 in £1 shares. Objects:—To acquire the business of an electrical and mechanical engineer carried on at 26, Cannon Street, Manchester, and at 34, Henblas Street, Wrexham, by E. O. Walker as "E. O. Walker & Co.," and to carry on the same and the business of refrigerating engineers, manufacturers, vendors or repairers of refrigerating, electric and mechanical engines, dynamos, &c. The first directors are:—E. O. Walker, "The Cottage," Delamere, Ches., electrical engineer (governing director); Mrs. M. Walker, "The Cottage," Delamere, Ches. (managing director of Electro Medical Treatments, Ltd., 10, South Parade, Manchester). Qualification of governing director, 250 shares; of other directors, 10 shares. Remuneration of governing director not less than £400. Solicitors: Robert Scholes & Co., 49, Princess Street, Manchester. Registered office: 26, Cannon Street, Manchester.

Leicol, Ltd. (217,752).—Registered November 25th. Private company. Capital, £250 in £1 shares. Objects:—To acquire the property, assets, and goodwill and all or any of the debts, liabilities, and engagements of F. Wilde and H. F. Kerley, trading as "Electrical Traders," at 64, Hanover Street, Liverpool, and to carry on the business of manufacturers of, and dealers in electrical, gas, and other fittings in wood or metal, &c. The permanent directors are:—F. Wilde, 4, Marmaduke Street, Edge Hill, Liverpool, electrical engineer (managing director); H. F. Kerley, 16, Promenade, Egremont, Ches., secretary. Qualification, 50 shares. Remuneration (except managing director) as fixed by the company. Secretary: H. F. Kerley. Registered office: 64, Hanover Street, Liverpool.

General Engineering Co. (Hucknall), Ltd. (217,874).—Private company. Registered December 1st. Capital, £3,000 in £1 shares. Objects:—To acquire the business of an electrical engineer and contractor carried on by G. K. Burrows at Ogle Street, Hucknall, Notts., as the General Engineering Co., and to carry on the same and the business of wireless, mechanical, ventilating, heating, sanitary, and general engineers, inventors, designers, and manufacturers of, and dealers in automatic and electric, magnetic, revolving, changeable, moveable, coloured, illuminated, and other signs, electrical goods, &c. The first directors are:—G. K. Burrows, "Shaftesbury House," Sandy Lane, Hucknall, Notts., engineer (chairman and permanent managing director); W. H. Brown, 30a, Linby Road, Hucknall, insurance agent; H. I. Mellows, 12, Wyburn Street, Hucknall, clerk (all permanent). Qualification, £150. Secretary: W. H. Brown.

Capel's Wholesale Wireless Co., Ltd. (217,897).—Private company. Registered December 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of radio and electrical engineers, &c. The subscribers (each with one share) are:—P. Capel, 98, Plasturton Avenue, Cardiff, wireless dealer; A. Capel, 23, Fitzhamon Embankment, Cardiff, wireless dealer. The first directors are to be appointed by the subscribers. Remuneration as fixed by the company. Secretary: W. A. Scholefield. Solicitors: Phœnix & Levinson, 8, Dumfries Street, Cardiff. Registered office: Capel's Buildings, Plymouth Street, Queen Street, Cardiff.

International Pads, Ltd. (217,819).—Private company. Registered November 27th. Capital, £5,000 in £1 shares (2,000 "A" and 3,000 "B"). Objects:—To acquire the business of manufacturers of, and dealers in accessories of all descriptions used in connection with telephones and office equipment carried on by J. King and J. Sewell at 11, Tavistock Square, W.C., as the "Telephone Supply Co." The subscribers (each with 1 "A" share) are:—T. M. Hunt, 60, Dalwood Road, Camberwell, clerk; Vera M. Turner, 11, Tavistock Square, W.C.1, private secretary. The permanent directors are:—J. King and J. Sewell. Remuneration and qualification of future directors as determined by the board. Solicitors: Francis Miller & Steele, 6, Finsbury Square, E.C.2.

Wooldridge Radio Co., Ltd. (217,870).—Private company. Registered November 30th. Capital, £100 in £1 shares. Objects: To adopt an agreement with P. Parry and Mabel Wooldridge; and to acquire the business of wireless apparatus and material manufacturers and dealers and dealers in electrical goods carried on by them at 26 and 39, Lisle Street, W.C., as the "Wooldridge Radio Co." The life directors are:—P. Parry, 48, Leigh Road, Highbury, N. (director of Harley Instrument Co., Ltd.); Mabel Wooldridge, 26, Lisle Street, Leicester Square, W.C.2, wholesale and retail woollen merchant. Solicitor: E. E. Kent, 5, Staple Inn, W.C.1. Registered office: 39, Lisle Street, Leicester Square, W.C.2.

Abba Electrical Co., Ltd. (217,857).—Private company. Registered November 30th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in electrical, radio and mechanical appliances and scientific instruments of all kinds, illuminated and other advertising signs, &c. The first directors are:—T. C. Hurley, Knightley, Waverley Road, Kenilworth, electrical engineer; J. W. Mackrell, Pine Croft, Ashorne, near Warwick, electrical engineer. Qualification, 100 shares. Remuneration as fixed by the company. Secretary: T. C. Hurley. Solicitor: E. A. B. Cox, 10a, Temple Row, Birmingham. Registered office: Abba Works, Engine Street, Smethwick.

Official Returns of Electrical Companies.

Vee Cee Drycell Co., Ltd.—Particulars filed of £2,500 debentures authorised November 1st, 1926, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,000.

James Keith & Blackman Co., Ltd.—Satisfaction in full on November 11th, 1926, of debentures dated October 29th, 1901, securing £1,500.

Excelsior Magneto and Ignition Co., Ltd.—C. R. W. Menzies, C.A., of 2, Mount Street, Manchester, was appointed receiver and manager on November 29th, 1926, under powers contained in debenture dated October 5th, 1922.

Morris Electrical Co., Ltd.—Debenture dated November 18th, 1926, to secure £200, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. L. Horwood, Bramble Hall, Dawes Heath, Thundersley, Essex.

Castle Fuse and Engineering Co., Ltd.—Mortgage on 31a and 33, Chester Street, Liverpool, with machinery, &c., and memorandum of deposit, charged on 72, Haigh Street, Liverpool, both dated November 22nd, 1926, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Lumos Radio Valve Co., Ltd.—A. Hart, of 442, Strand, W.C.2, ceased to act as receiver or manager on November 1st, 1926.

Colne Valley Electric Supply Co., Ltd.—Trust deed dated November 20th, 1926 (supplemental to trust deed dated July 4th, 1925) to secure £100,000 debenture stock, inclusive of £75,000 secured by the original deed, charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: Union Commercial Investment Co., Ltd., Dashwood House, 69, Old Broad Street, E.C.

S. G. Leach & Co., Ltd.—Particulars filed of £14,000 first mortgage debenture stock authorised November 5th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

North Wales Power Co., Ltd.

Mr. Kenneth M. Clark (chairman) presided at the annual meeting, on December 1st, and in moving the adoption of the report and accounts (*vide* our last issue, p. 926), said that the total profit in hand (£24,104) was more than sufficient to cover the preference dividend. However, in view of the fact that they had encountered considerable difficulties in the construction work and had decided to spend larger sums than were actually needed in order to save money in future developments, Sir Robert McAlpine & Sons and himself, the holders of the preference shares, had agreed, in addition to subscribing for £50,000 further preference shares, to wait until the conclusion of the construction period for their dividend. At the date of the balance sheet the company had liquid resources in hand for the completion of the construction programme amounting to about £1,400,000. The investments in associated companies had been increased by the purchase of ordinary shares of the Electricity Distribution of North Wales and District, Ltd., from whose operations they anticipated considerable benefits. The sales of energy showed an increase of 30 per cent. over those of the previous year; Abergele, Rhuddlan, Hawarden, Crewe and Flint had been added to the list of towns supplied and a supply had been given to the L.M.S. Railway works at Crewe. The extension of transmission lines had been continued, but wayleave difficulties had been encountered. The Distribution Company had been formed to undertake the supply of electricity in districts in which neither the local authorities nor private enterprise were willing to carry on the business. They had devised a scheme of mutual supply between themselves and collieries which, they hoped, would lead to very great developments. With regard to their general scheme, in the first place they were building e.h.p. lines to link up the hydro-electric stations at Dolgarrog, Cwm Dyli, and Maentwrog. They had connected the large station of the Mersey Power Co., and in the Wrexham area they hoped to connect up a number of important collieries. They had two duplicate main lines from Dalgarrog to Hawarden and Wrexham (along the coast), and from Maentwrog to Wrexham straight across the hills. The new hydro-electric station at Maentwrog was making good progress. The controlling of the waters called for four dams; three were nearing completion, and the fourth was well in hand. The first two machines were nearing completion, and should be ready for delivery early in the New Year. The low-level conduit, two miles long, had been built of a capacity far in excess of their present needs, and provision had also been made for the future in the design of the power station.

The report and accounts were adopted.

Bogota Telephone Co., Ltd.

The report for the year ended June 30th last records a gross revenue of £42,382 and a profit of £23,063, to which is added £8,153 brought forward, making £31,216. £5,000 has been transferred to the depreciation account and a dividend of 12½ per cent. was paid on November 1st, leaving £8,265 to be carried forward. The existing equipment in Bogotá is working at its full capacity, and there are a considerable number on the waiting list. The exchange building is being extended to render it capable of accommodating double the present facilities, and orders have been placed for further equipment. To meet the cost of this it is proposed to increase the capital from £150,000 to £300,000 in ordinary shares, the new shares to be issued as and when required. The necessary resolution will be placed before the shareholders at the meeting on December 14th. Mr. E. C. Quilter has been appointed a director.

Callender's Share and Investment Trust, Ltd.

The net profit for the year ended August 31st last was £13,264, as against £12,802 in the preceding year. It is proposed to transfer £500 to reserve, to write £1,710 off for various expenses, and to pay a final dividend of 5 per cent., making 8 per cent. for the year. This leaves £468, which is added to the balance of £16,201 brought in and carried forward. During the year a substantial portion of the loan to Callender's Cable and Construction Co., Ltd., has been satisfied by the purchase from that company of a number of securities which has increased the Trust's investments and shares by £122,917, and an increase in the annual revenue is expected.

Burma Electric Supply Co., Ltd.

The annual meeting was held on December 1st, Mr. C. O. Webb (chairman) presiding. In presenting the report (*vide* our last issue, p. 926), the chairman drew attention to the increased profit, which, he said, was mainly due to the lower expenditure upon repairs and maintenance as compared with the previous year. The capital expenditure was £11,434, the main item being a new 500-h.p. Diesel engine and generator. A motor-bus chassis was purchased, that being the first of a number which would be used as feeders to the tramways. As mentioned in the report, it was proposed to capitalise £20,000 of the reserve which was represented by assets and issue it in the form of £1 shares to the ordinary shareholders. The report and accounts were adopted, and the capitalisation of the reserves was approved.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

London Power Co., Ltd.—£4,000,000 new 5 per cent. redeemable debenture stock, issued at 95 per cent., partly paid and fully paid.

The undermentioned have been ordered to be officially quoted:—

Chelsea Electricity Supply.—148,308 ordinary shares of £1 each, fully paid, Nos. 247,181 to 370,000 and 400,001 to 425,488.

International Automatic Telephone.—430,000 ordinary shares of £1 each, fully paid, Nos. 1 to 430,000.

International Light and Power.—£27,500 five per cent. first mortgage debentures, Nos. 5,601 to 5,875.

Llanelly and District Electric Supply.—10,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 490,001 to 500,000.

Westminster Electric Supply Corporation.—503,746 ordinary shares of £1 each, fully paid, Nos. 755,621 to 1,200,000 and 1,750,001 to 1,809,366.

City of London Electric Lighting Co., Ltd.—A report issued by the directors, covering the year ended December 31st, 1925, contains the proviso that it shows the position of the company if all its claims are admitted. It deals with the position of the company under the London Electricity (No. 1) Act and intimates that delay has occurred in settling matters with the authorities concerned. The meeting is to be held on Wednesday next, and it will be followed by an extraordinary meeting to deal with the capitalisation of reserves. The total revenue for the year was £799,200, and the amount of energy sold was 62,495,055 kWh.

Metropolitan Electric Supply Co., Ltd.—This company has announced a scheme for the capitalisation of free reserves under the London Electricity Acts. It is proposed to increase the capital to £2,000,000 by the creation of 500,000 ordinary shares, which will be issued to the ordinary shareholders, fully paid, in the proportion of one new share for each two held. The necessary amount will be taken from the reserve fund, which stood at £889,259 at December 31st last.

West India and Panama Telegraph Co., Ltd.—The receipts for the year ended December 31st, 1925, amounted to £48,898, and there is a debtor balance of £18,328. After crediting interest and providing for debenture interest, &c., there is a debit of £28,710, which is being added to the adverse balance of £105,900 brought forward. Considerable economies have been effected and the rates have been changed in certain respects. Meeting: December 15th.

Manx Electric Railway Co., Ltd.—The accounts for the year ended September 30th record receipts of £43,310 gross and £12,323 net. To the latter amount is added £1,826 brought forward, making £14,149. After providing for debenture interest, &c., it is proposed to pay the preference dividend for the half-year ended March 31st, 1923 (2½ per cent.), and to carry forward £139.

Foundation Co., Ltd.—This company reports an available balance of £58,103 (including £11,679 brought forward); it is proposed to pay a dividend at the rate of 8 per cent. on the cumulative participating preference shares, to provide £7,000 for taxation, to write £10,000 off preliminary expenses, &c., to transfer £15,000 to reserve, and to carry forward £16,503.

John I. Thornycroft, Ltd.—Speaking at the annual meeting on November 30th, the chairman (Sir John E. Thornycroft, K.B.E., said that the business had been badly affected by the general strike and coal dispute. Fortunately the commercial vehicle branch was little affected and consequently they were able to show an improvement.

Dorman, Long & Co., Ltd.—The directors state that there was an actual loss of £178,962 during the past year, and that after allowing for debenture interest, &c., the deficit is £434,408. In the preceding year the working profit was £231,170, and a balance of £122,055 was carried forward.

Armstrong Whitworth Development Co., Ltd.—Dividends amounting to 15 per cent., together with a bonus of 5 per cent., free of tax, have been declared on the ordinary shares out of an available balance of £134,564, including £31,291 brought forward.

Brazilian Traction, Light and Power Co., Ltd.—A quarterly dividend of 1½ per cent. (payable January 1st) has been declared on the cumulative preference shares.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The final dividend has been declared on the 6 per cent. cumulative preference shares.

Petters, Ltd.—The half-yearly dividend has been declared on the 7½ per cent. cumulative preference shares.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are not in a very happy frame of mind. The gravity of the situation in China is the latest reason for depression amongst many stocks and shares, investment and speculative alike. This accentuates the reluctance, always observable as a year draws to its close, of capital to leave its resting-place in the banks. Customers like to see as good a balance as possible on New Year's Day. The fall in the franc, a drop in the price of rubber, a prevailing uncertainty as to the possible after-effects of the coal strike, and a fear of heavier taxation are amongst the financial factors of the moment. Nevertheless, money is open to temptation, as the saying is, and a line of 260,000 International Automatic Telephone deferred shares found ready buyers at 35s., the price subsequently rising to nearly £2.

The question raised here last week as to the correct method for calculating dividends and yields on the ordinary shares of the London electricity supply companies has received an indirect reply from official quarters. It is pointed out that dividends will be declared at a single rate, on old shares and new shares equally, for the next five years, during which period the companies can earn more, on their existing capital, than the 7 per cent. to which they will be restricted (save in certain circumstances) after 1931 on all their ordinary shares. This introduces the possibility of variable dividends for the ensuing five years, although it is not difficult to estimate what the companies are likely to distribute. We adhere to the 7 p.c. basis for reckoning yields, but until 1931 the returns will, actually, be higher.

The Metropolitan Electric Supply Company announces a capitalisation, and subsequent distribution, of reserves that will give one new share in respect of every two shares now held. This is hardly as good as the optimists expected. For some reason, Metropolitans had been singled out by speculative investors as a very promising purchase. The price rose to 42s. 6d., from which it had a mild reaction to 40s. 9d. On the announcement of the bonus, Metropolitans went back to 39s., but nominally they are unchanged on the week. Chelseas have risen 6d. and County of London drooped to 3½.

Brazilian Tractions are moving sharply, and in accordance with the tendency of foreign bourses. Brussels came in a large buyer on Monday in this week, and the price gained 2 points at 110. Anglo-Argentine Trams rallied after their fall on the threatened competition of new tubes in Buenos Ayres. The 5 per cent. consolidated debenture stock of the Buenos Ayres Lacroze Tramways has attracted a little attention by reason of its low price, and stock is changing hands around 63. British Columbia Electric issues remain good, but the Mexican group is in a somewhat melancholy mood.

General Electrics further strengthened to 31s. 6d. and Ever Ready shares, after being 3 9/16, found buyers at 3⅝. The preference, at 27s. 6d., are a little better, and the new shares, issued at 50s., keep about 22s. 6d. premium. The engineering and iron section is dull for choice, Babcocks showing 1s. loss at 53s. It is thought that the effects of the coal strike are likely to remain very evident for some time to come, and will cause unexpected disturbances: a temporary glut of coal and fall in price might bring about developments quite unlooked for at present.

Home Railway stocks are no better off than they were before the coal settlement. Districts, Metropolitans and Underground Electrics have moved back. The public refuse resolutely to look with favour upon the steam companies' stocks.

The new London Power 5 per cent. debenture scrip stands at about ¾ premium. Dealings in the newly-issued Lancashire Electric preference will begin as soon as the allotments are out. Many inquiries are made concerning the big provincial power companies and the manner in which the Government's electricity proposals are likely to react upon the undertakings. If everything goes through according to plan, if the companies are permitted full play to their energies and scope, if Government officials refrain from fussy and futile interference, there is no reason why the companies should not benefit equally with the public. The shareholders may claim, justifiably, that their money and their courage have done pioneer work of national service and that a policy of far-seeing intelligence can give the country that supply of cheap electricity which everyone demands. But nobody can tell what a Government department may—or may not—do, and herein lurks the essence of the speculation, attaching to what should be a form of steady, progressive investment.

Cable stocks are uninteresting. The Eastern issues show a disposition to dwindle. A disastrous report from the West India and Panama Telegraph Company states that the net working loss for last year was £18,200. To the end of December 31st, the debit balance came to £105,900. There is not much doing in Marconi and other wireless shares. Rubber shares turned a shade better, after being weak; it is stated that a pool has been formed, in the United States, by some of the principal consumers who desire to see greater stability in the market for the commodity. To this end, a substantial amount of money is reported to have been subscribed which it is hoped will be utilised in the purchase of raw rubber.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Dec. 6 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	1⅛	—	6 18 4
Charing Cross Ordinary	1	15	15	2 1/16	—	6 9 9
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	+6d.	5 12 0
City of London	1	15	15	59/9	—	5 18 3
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	8⅛	—⅛	4 14 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	36/9	—	5 19 8
do. 7% Pref.	1	6	7	28/-	—	5 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/6	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/6	—	6 2 5
London Electric	1	10	10	36/-	—	5 11 1
do. do. 6% Pref.	5	6	6	5⅝	—	5 11 7
Metropolitan	1	11	11	40/9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary ...	1	7	7	21/8	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	24/6	—	5 14 3
South London	1	15	15	25	—	5 14 3
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	7	1¼	—	5 12 0
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	25/6xr	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	61½	—½	8 2 8
do. District	,,	3½	3½	55½	−1	6 6 2
Underground Electric	£1	Nil	Nil	12/-	−6d.	Nil
do. do. Income ...	Bonds	6	6	102	—	*5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	25	+½	6 0 0
Automatic Telephone	1	8	10	2 1/2	—	3 16 7
Chili Telephone	5	5	6	6⅝	—	4 7 4
Cuba Sub. Ord.	10	5	5	7⅛	—	7 0 4
Eastern Extension	10	10	10	18	—⅛	*5 11 4
Eastern Tel. Ord.	Stock	10	10	180½	—	*5 10 10
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 6 8
do. do. Pref.	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	9½	10	47½	—	*5 5 10
Marconi	1	10	Nil	⅛	—	... ...
Marconi-Marine	1	10	7½	1⅛	—	6 13 4
Oriental Telephone Ord.	1	12	12	2 7/16	—	*4 18 4
United R. Plate Tel.	5	8	8	7 1/2	—	*5 2 5
Western Telegraph	10	10	10	17½	—¼	*5 14 3

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2 1/2	+ 1/16	9 15 6
do. do. 2nd Pref. ...	5	6	6	2⅞	+ 1/16	10 8 8
do. do. 5% Deb. ...	Stock	5	5	65½	—	7 12 8
British Electric Traction Ord. ...	,,	7	8	142½	—	5 12 3
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	160	4	5	110	+2	4 10 9
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	86½	—	5 15 7
do. do. Preferred ...	,,	9/-	136/9	118½	+1	*5 15 6
do. do. Deferred ...	,,	129/5	8	147½	—	*5 10 4
do. do. Deb. ...	,,	4½	4½	77½	—	5 10 0
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	62½	−1	8 0 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	76½	—	Nil
do. 1st Bonds	—	5	5	£4½	−1	7 15 0
Yorkshire (West Riding)	1	6	—	12/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	53/-	- 1	4 10 10
British Aluminium Ord.	1	5	10	47/6	—	4 4 3
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	67/-	—	4 9 7
Brush Ord.	1	10	10	28/3	—	7 12 4
Callenders	1	15	15	3¾	—	4 13 4
do. 6½% Pref.... ...	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	31/3	−9d.	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 13 1
do. Ord.	1	5	7½	31/6	+6d.	4 15 3
Henley	1	16	20	4xd	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 9 0
Johnson & Phillips	1	10	17½	56/3	—	6 0 2
Met.-Vickers Ord.	1	8	8	33/9	—	6 14 9
do. Pref.	2	8	8	2 1/16	—	6 18 4
Siemens Ord.	1	7½	7½	28/9	−9d.	5 4 4
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

United States Electrical Exports.

The following figures, showing the exports of electrical machinery and apparatus from the United States and the principal countries of destination in 1925 are taken from the recently-issued annual statistics of American trade. The comparative figures for 1924 have been added and notes of any increases or decreases given.

According to the official statistics the total values in thousands of dollars of the exports of electrical machinery and apparatus since 1910 have been as follows:—

Av. 1915-19	...	41,317	1922	...	53,147
			1923	...	59,927
1920	...	93,184	1924	...	69,828
			1925	...	73,790
Av. 1910-14	...	21,094	1921	...	88,931

Insulated wires and cables, although shown below, are not classed in the United States statistics as electrical goods.

	1924.	1925.	Inc. or dec.
Generators, d.c., under 500 kW—	$	$	$
Total	1,067,000	848,000	− 219,000
To France	149,000	57,000	− 92,000
,, Canada	273,000	217,000	− 56,000
,, Mexico	100,000	95,000	− 5,000
,, Colombia	36,000	33,000	− 3,000
,, Venezuela	18,000	25,000	+ 7,000
,, China	14,000	5,000	+ 9,000
,, Japan	77,000	11,000	− 66,000
,, Australia	40,000	27,000	− 13,000
,, Cuba	68,000	64,000	− 4,000
Generators, d.c., 500 kW and over—			
Total	850,000	428,000	− 422,000
To Spain	—	71,000	+ 71,000
,, Canada	45,000	25,000	− 20,000
,, Cuba	42,000	97,000	+ 55,000
,, Brazil	24,000	82,000	+ 58,000
,, Chile	67,000	—	− 67,000
,, Japan	159,000	54,000	− 105,000
,, Italy	53,000	—	− 53,000
,, Mexico	161,000	66,000	− 95,000
,, Dutch East Indies ...	50,000	—	− 50,000
,, Philippine Islands ...	56,000	—	− 56,000
Generators, a.c., under 2,000 kVA—			
Total	169,000	303,000	+ 134,000
To Canada	26,000	31,000	+ 5,000
,, Mexico	9,000	26,000	+ 17,000
,, Argentina	—	1,000	+ 1,000
,, Colombia	15,000	4,000	− 11,000
,, Cuba	23,000	37,000	+ 14,000
,, Japan	30,000	3,000	− 27,000
Generators, a.c., 2,000 kVA and over—			
Total	1,157,000	1,901,000	+ 744,000
To Italy	34,000	—	− 34,000
,, Spain	54,000	92,000	+ 38,000
,, Canada	27,000	3,000	− 24,000
,, Mexico	26,000	68,000	+ 42,000
,, Cuba	23,000	78,000	+ 55,000
,, Brazil	3,000	177,000	+ 174,000
,, China	20,000	14,000	− 6,000
,, Japan	843,000	1,437,000	+ 594,000
,, India	71,000	22,000	− 49,000
Steam turbine generator sets—			
Total	75,000	795,000	+ 720,000
To Mexico	23,000	88,000	+ 65,000
,, Cuba	26,000	120,000	+ 94,000
,, Japan	—	437,000	+ 437,000
,, Brazil	—	44,000	+ 44,000
Self-contained lighting outfits—			
Total	780,000	1,076,000	+ 296,000
To Spain	17,000	10,000	− 7,000
,, Great Britain	83,000	128,000	+ 45,000
,, Mexico	23,000	54,000	+ 31,000
,, Argentina	140,000	146,000	+ 6,000
,, Colombia	7,000	14,000	+ 7,000
,, Cuba	52,000	55,000	+ 3,000
,, Uruguay	45,000	61,000	+ 16,000
,, India	5,000	17,000	+ 12,000
,, Australia	144,000	180,000	+ 36,000
,, British South Africa ...	42,000	83,000	+ 41,000
Power transformers—			
Total	3,286,000	2,175,000	−1,111,000
To Cuba	260,000	238,000	− 22,000
,, France	26,000	5,000	− 21,000
,, Canada	46,000	52,000	+ 6,000
,, Mexico	224,000	154,000	− 70,000
,, Brazil	204,000	222,000	+ 18,000
,, Chile	67,000	138,000	+ 71,000
,, India	62,000	90,000	+ 28,000
,, China	8,000	21,000	+ 13,000
,, Japan	1,696,000	624,000	−1,072,000
,, Australia	40,000	181,000	+ 141,000
,, Spain	65,000	178,000	+ 113,000

	1924.	1925.	Inc. or dec.
Other transformers—	$	$	$
Total	2,368,000	1,315,000	−1,053,000
Accessories and parts for generators—			
Total	1,270,000	1,089,000	− 181,000
Rectifiers, double current, and motor generators, dynamotors, synchronous and other convertors—			
Total	1,157,000	967,000	− 190,000
To France	206,000	50,000	− 156,000
,, Great Britain	53,000	56,000	+ 3,000
,, Canada	146,000	185,000	+ 39,000
,, Mexico	37,000	32,000	− 5,000
,, Chile	13,000	59,000	+ 46,000
,, Uruguay	2,000	4,000	+ 2,000
,, India	22,000	15,000	− 7,000
,, Japan	347,000	73,000	− 274,000
,, Australia	54,000	75,000	+ 21,000
,, Spain	43,000	21,000	− 22,000
,, Brazil	79,000	28,000	− 51,000
Switchboard panels, except telephone—			
Total	2,163,000	2,305,000	+ 142,000
Switches and circuit breakers over 10 amp.—			
Total	2,245,000	2,424,000	+ 179,000
Fuses and fuse blocks—			
Total	282,000	343,000	+ 61,000
Watt-hour and other measuring instruments—			
Total	624,000	447,000	− 177,000
To Canada	44,000	58,000	+ 14,000
,, Mexico	55,000	71,000	+ 16,000
,, Cuba	65,000	70,000	+ 5,000
,, Brazil	100,000	119,000	+ 19,000
,, China	57,000	11,000	− 46,000
,, Japan	183,000	23,000	− 160,000
Volt-, watt-, ampere-, and other recording &c., apparatus—			
Total	1,367,000	1,696,000	+ 329,000
Lightning arrestors, choke coils, &c.—			
Total	920,000	707,000	− 213,000
Motors, under 1 h.p.—			
Total	1,687,000	2,102,000	+ 415,000
To Holland	32,000	38,000	+ 6,000
,, Spain	42,000	41,000	− 1,000
,, Great Britain	286,000	399,000	+ 113,000
,, New Zealand	36,000	53,000	+ 17,000
,, Canada	537,000	572,000	+ 35,000
,, Mexico	30,000	38,000	+ 8,000
,, Argentina	41,000	77,000	+ 36,000
,, Japan	194,000	100,000	− 94,000
,, Australia	101,000	132,000	+ 31,000
Stationary motors, 1 to 200 h.p.—			
Total	2,392,000	2,472,000	+ 80,000
To Spain	93,000	193,000	+ 100,000
,, Great Britain	88,000	51,000	− 37,000
,, Canada	428,000	578,000	+ 150,000
,, Mexico	199,000	248,000	+ 49,000
,, Cuba	144,000	195,000	+ 51,000
,, Brazil	70,000	69,000	− 1,000
,, Chile	77,000	105,000	+ 28,000
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,, Australia	172,000	132,000	− 40,000
,, British South Africa ...	81,000	47,000	− 34,000
Motors, over 200 h.p.—			
Total	576,000	604,000	+ 28,000
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,, Japan	126,000	49,000	− 77,000
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,, France	16,000	65,000	+ 49,000
,, Spain	138,000	86,000	− 52,000
Railway motors—			
Total	1,328,000	808,000	− 520,000
To Canada	25,000	32,000	+ 7,000
,, France	307,000	—	− 307,000
,, Spain	201,000	151,000	− 50,000
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,, Japan	82,000	355,000	+ 273,000
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Starting and controlling equipment—			
Totals—			
For industrial motors ...	1,429,000	1,159,000	− 270,000
For electric railway and vehicle motors	107,000	278,000	+ 171,000
Accessories and parts for motors—			
Total	1,998,000	2,040,000	+ 42,000

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are not in a very happy frame of mind. The gravity of the situation in China is the latest reason for depression amongst many stocks and shares, investment and speculative alike. This accentuates the reluctance, always observable as a year draws to its close, of capital to leave its resting-place in the banks. Customers like to see as good a balance as possible on New Year's Day. The fall in the franc, a drop in the price of rubber, a prevailing uncertainty as to the possible after-effects of the coal strike, and a fear of heavier taxation are amongst the financial factors of the moment. Nevertheless, money is open to temptation, as the saying is, and a line of 260,000 International Automatic Telephone deferred shares found ready buyers at 35s., the price subsequently rising to nearly £2.

The question raised here last week as to the correct method for calculating dividends and yields on the ordinary shares of the London electricity supply companies has received an indirect reply from official quarters. It is pointed out that dividends will be declared at a single rate, on old shares and new shares equally, for the next five years, during which period the companies can earn more, on their existing capital, than the 7 per cent. to which they will be restricted (save in certain circumstances) after 1931 on all their ordinary shares. This introduces the possibility of variable dividends for the ensuing five years, although it is not difficult to estimate what the companies are likely to distribute. We adhere to the 7 p.c. basis for reckoning yields, but until 1931 the returns will, actually, be higher.

The Metropolitan Electric Supply Company announces a capitalisation, and subsequent distribution, of reserves that will give one new share in respect of every two shares now held. This is hardly as good as the optimists expected. For some reason, Metropolitans had been singled out by speculative investors as a very promising purchase. The price rose to 42s. 6d., from which it had a mild reaction to 40s. 9d. On the announcement of the bonus, Metropolitans went back to 39s., but nominally they are unchanged on the week. Chelseas have risen 6d. and County of London drooped to 3¼.

Brazilian Tractions are moving sharply, and in accordance with the tendency of foreign bourses. Brussels came in a large buyer on Monday in this week, and the price gained 2 points at 110. Anglo-Argentine Trams rallied after their fall on the threatened competition of new tubes in Buenos Ayres. The 5 per cent. consolidated debenture stock of the Buenos Ayres Lacroze Tramways has attracted a little attention by reason of its low price, and stock is changing hands around 63. British Columbia Electric issues remain good, but the Mexican group is in a somewhat melancholy mood.

General Electrics further strengthened to 31s. 6d. and Ever Ready shares, after being 3 9/16, found buyers at 3¾. The preference, at 27s. 6d., are a little better, and the new shares, issued at 50s., keep about 22s. 6d. premium. The engineering and iron section is dull for choice, Babcocks showing 1s. loss at 53s. It is thought that the effects of the coal strike are likely to remain very evident for some time to come, and will cause unexpected disturbances: a temporary glut of coal and fall in price might bring about developments quite unlooked for at present.

Home Railway stocks are no better off than they were before the coal settlement. Districts, Metropolitans and Underground Electrics have moved back. The public refuse resolutely to look with favour upon the steam companies' stocks.

The new London Power 5 per cent. debenture scrip stands at about ¾ premium. Dealings in the newly-issued Lancashire Electric preference will begin as soon as the allotments are out. Many inquiries are made concerning the big provincial power companies and the manner in which the Government's electricity proposals are likely to react upon the undertakings. If everything goes through according to plan, if the companies are permitted full play to their energies and scope, if Government officials refrain from fussy and futile interference, there is no reason why the companies should not benefit equally with the public. The shareholders may claim, justifiably, that their money and their courage have done pioneer work of national service and that a policy of far-seeing intelligence can give the country that supply of cheap electricity which everyone demands. But nobody can tell what a Government department may—or may not—do, and herein lurks the essence of the speculation, attaching to what should be a form of steady, progressive investment.

Cable stocks are uninteresting. The Eastern issues show a disposition to dwindle. A disastrous report from the West India and Panama Telegraph Company states that the net working loss for last year was £18,200. To the end of December 31st, the debit balance came to £165,900. There is not much doing in Marconi and other wireless shares. Rubber shares turned a shade better, after being weak; it is stated that a pool has been formed, in the United States, by some of the principal consumers who desire to see greater stability in the market for the commodity. To this end, a substantial amount of money is reported to have been subscribed which it is hoped will be utilised in the purchase of raw rubber.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	1925.	Price Dec. 6 1926.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.	£					
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	1½	—	6 13 4
Charing Cross Ordinary	1	15	15	2⅛	—	6 9 9
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	+6d.	5 12 0
City of London	1	15	15	50/9	—	5 18 3
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	3¼	—¼	4 14 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	94/6	—	5 16 8
Lancs. Light and Power	1	7½	7½	94/6	—	6 2 5
London Electric	1	10	10	86/-	—	5 11 1
do. do. 6% Pref.	5	6	6	5¾	—	5 11 7
Metropolitan	1	11	11	40/9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary ...	1	7	7	21/8	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	24/6	—	5 14 3
South London	1	15	15	2⅜	—	5 14 3
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	7	1¼	—	5 12 0
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	25/6xr	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	89	—	5 15 11
Metropolitan	,,	5	5	61½	—½	8 2 8
do. District	,,	8½	9½	85½	−1	6 6 2
Underground Electric	£1	Nil	Nil	12/-	−6d.	Nil
do. do. Income ...	Bonds	6	6	102	—	*5 17 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	25	+½	6 0 0
Automatic Telephone	1	8	10	2½	—	8 16 7
Chili Telephone	5	5	6	6¼	—	4 7 4
Cuba Sub. Ord.	10	5	5	7½	—	7 0 4
Eastern Extension	10	10	10	18	—½	*5 11 4
Eastern Tel. Ord.	Stock	10	10	180½	—	*5 10 10
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 6 8
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8½	10	47½	—	*5 5 10
Marconi	1	10	Nil	⅛	—	... ...
Marconi-Marine	1	10	7½	1½	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅞	—	*4 18 4
United R. Plate Tel.	5	8	8	7⅛	—	*5 2 5
Western Telegraph	10	10	10	17½	—½	*5 14 3
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	2⅛	+⅛	9 15 6
do. do. 2nd Pref. ...	5	6	6	2⅜	+⅛	10 8 8
do. do. 5% Deb. ...	Stock	5	5	65½	—	7 12 8
British Electric Traction Ord. ...	,,	7	8	142½	—	5 12 3
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	110	+2	4 10 9
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	96½	—	5 15 7
do. do. Preferred ...	,,	96/-	136/9	118½	+1	*5 15 6
do. do. Deferred ...	,,	129/5	8	147½	—	*5 10 4
do. do. Deb. ...	,,	4½	4½	77½	—	5 10 0
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	62½	−1	8 0 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	76½	—	Nil
do. 1st Bonds	—	5	5	£4½	−1	7 15 0
Yorkshire (West Riding)	1	5	—	12/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	13	53/-	−1	4 10 10
British Aluminium Ord.	1	5	10	47/6	—	4 4 3
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	67/-	—	4 9 7
Brush Ord.	1	10	10	28/3	—	7 12 4
Callenders	1	15	15	3¾	—	4 12 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	8 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 8
Electric Construction	1	10	10	31/3	−9d.	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	2+/-	—	5 18 1
do. Ord.	1	5	7½	31/6	+6d.	4 15 3
Henley	1	16	20	4xd	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 9 0
Johnson & Phillips	1	10	17½	55/3	—	6 0 2
Met.-Vickers Ord.	1	8	8	23/9	—	6 14 9
do. Pref.	2	8	8	2⅛	—	6 18 4
Siemens Ord.	1	7½	7½	2-/9	−9d.	5 4 4
Telegraph Construction	10	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

United States Electrical Exports.

THE following figures, showing the exports of electrical machinery and apparatus from the United States and the principal countries of destination in 1925 are taken from the recently-issued annual statistics of American trade. The comparative figures for 1924 have been added and notes of any increases or decreases given.

According to the official statistics the total values in thousands of dollars of the exports of electrical machinery and apparatus since 1910 have been as follows :—

Av. 1915-19	...	41,317	1922	...	53,147
			1923	...	59,927
1920	...	93,184	1924	...	69,828
			1925	...	73,790
Av. 1910-14	...	21,094	1921	...	88,931

Insulated wires and cables, although shown below, are not classed in the United States statistics as electrical goods.

	1924.	1925.	Inc. or dec.
Generators, d.c., under 500 kW—	$	$	$
Total	1,067,000	848,000	− 219,000
To France	149,000	57,000	− 92 000
,, Canada	273,000	217,000	− 56,000
,, Mexico	100,000	95,000	− 5,000
,, Colombia	36,000	33,000	− 3,000
,, Venezuela	18,000	25,000	+ 7,000
,, China	14,000	5,000	+ 9,000
,, Japan	77,000	11,000	− 66,000
,, Australia	40,000	27 000	− 13,000
,, Cuba	68,000	64,000	− 4,000
Generators, d.c., 500 kW and over—			
Total	850,000	428,000	− 422,000
To Spain	—	71,000	+ 71,000
,, Canada	45.000	25,000	− 20,000
,, Cuba	42 000	97,000	+ 55,000
,, Brazil	24,000	82,000	+ 58,000
,, Chile	67.000	—	− 67,000
,, Japan	159 000	54,000	− 105,000
,, Italy	53,000	—	− 53,000
,, Mexico	161.000	66,000	− 95.000
,, Dutch East Indies ...	50 000	—	− 50,000
,, Philippine Islands ...	56,000	—	− 56,000
Generators, a.c., under 2,000 kVA—			
Total	169.000	303,000	+ 134,000
To Canada	26,000	31 000	+ 5,000
,, Mexico	9,000	26,000	+ 17,000
,, Argentina	—	1,000	+ 1,000
,, Colombia	15,000	4,000	− 11,000
,, Cuba	23.000	37,000	+ 14,000
,, Japan	30,000	3,000	− 27,000
Generators, a.c., 2,000 kVA and over—			
Total	1,157,000	1,901,000	+ 744,000
To Italy	34,000	—	− 34,000
,, Spain	54,000	92,000	+ 38.000
,, Canada	27.000	3,000	− 24.000
,, Mexico	26,000	68,000	+ 42.000
,, Cuba	23 000	78.000	+ 55 000
,, Brazil	3,000	177,000	+ 174,000
,, China	20.000	14.000	− 6.000
,, Japan	843.000	1,437.000	+ 594.000
,, India	71.000	22,000	− 49,000
Steam turbine generator sets—			
Total	75.000	795,000	+ 720,000
To Mexico	23.000	88 000	+ 65.000
,, Cuba	26,000	120,000	+ 94,000
,, Japan	—	437,000	+ 437.000
,, Brazil	—	44,000	+ 44,000
Self-contained lighting outfits—			
Total	780.000	1,076,000	+ 296,000
To Spain	17,000	10.000	− 7,000
,, Great Britain	83,000	128,000	+ 45.000
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,, Argentina	140.000	146,000	+ 6,000
,, Colombia	7.000	14,000	+ 7 000
,, Cuba	52,000	55,000	+ 3.000
,, Uruguay	45,000	61,000	+ 16 000
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,, Japan	194.000	100.000	− 94.000
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,, Japan	383.000	118 000	− 265.000
,, Australia	172.000	132.000	− 40.000
,, British South Africa ...	81.000	47,000	− 34,000
Motors, over 200 h.p.—			
Total	576.000	604.000	+ 28.000
To Mexico	44.000	35.000	− 9 000
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,, Japan	126.000	49.000	− 77.000
,, British S. Africa	21.000	9.000	− 12 000
,, France	16.000	65 000	+ 49.000
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Total	1,998,000	2,040,000	+ 42,000

	1924. $	1925. $	Inc. or dec. $
Railway signals, switches, and attachments—			
Total	964,000	803,000	– 161,000
To Canada	160,000	154,000	– 6,000
,, Japan	109,000	99,000	– 10,000
,, Chile	115,000	107,000	– 8,000
,, Australia	184,000	149,000	– 35,000
Insulating material—			
Total	1,536,000	1,545,000	+ 9,000
To France	58,000	60,000	+ 2,000
,, Great Britain	492,000	426,000	– 66,000
,, Canada	254,000	272,000	+ 18,000
,, Japan	199,000	129,000	– 70,000
,, Australia	65,000	84,000	+ 19,000
Fans—			
Total	1,028,000	917,000	– 111,000
To Canada	51,000	53,000	+ 2,000
,, Argentina	61,000	143,000	+ 82,000
,, China	76,000	99,000	+ 23,000
,, British India	59,000	60,000	+ 1,000
,, Australia	54,000	57,000	+ 3,000
,, Cuba	71,000	113,000	+ 42,000
,, Mexico	68,000	61,000	– 7,000
,, Great Britain	58,000	24,000	– 34,000
,, Japan	272,000	35,000	– 237,000
,, Hong-Kong	93,000	106,000	+ 13,000
Heating and cooking apparatus—			
Total	1,104,000	1,340,000	+ 236,000
To Norway	6,000	5,000	– 1,000
,, Great Britain	114,000	196,000	+ 82,000
,, Canada	235,000	254,000	+ 19,000
,, Japan	127,000	36,000	– 91,000
,, Argentina	54,000	72,000	+ 18,000
,, Australia	176,000	214,000	+ 38,000
,, Mexico	63,000	89,000	+ 26,000
,, Brazil	13,000	25,000	+ 12,000
Motor-driven household devices—			
Total	888,000	1,206,000	+ 318,000
To Holland	100,000	120,000	+ 20,000
,, Great Britain	303,000	404,000	+ 101,000
,, Canada	151,000	208,000	+ 57,000
,, Japan	22,000	21,000	– 1,000
,, Australia	59,000	132,000	+ 73,000
,, Belgium	67,000	42,000	– 25,000
Industrial electric furnaces and ovens—			
Total	240,000	252,000	+ 12,000
Metal filament lamps—			
Total	1,070,000	1,250,000	+ 180,000
To Canada	70,000	23,000	– 47,000
,, Peru	31,000	23,000	– 8,000
,, Mexico	171,000	274,000	+ 103,000
,, Cuba	183,000	196,000	+ 13,000
,, Argentina	98,000	128,000	+ 30,000
,, Brazil	30,000	21,000	– 9,000
,, Australia	130,000	118,000	– 12,000
,, British South Africa ...	38,000	26,000	– 12,000
,, Chile	48,000	55,000	+ 7,000
Magnetos, spark plugs, &c.—			
Total	1,911,000	2,708,000	+ 797,000
To Italy	82,000	193,000	+ 111,000
,, Great Britain	113,000	641,000	+ 528,000
,, Canada	443,000	516,000	+ 73,000
,, Argentina	95,000	102,000	+ 7,000
,, India	23,000	30,000	+ 7,000
,, Japan	151,000	95,000	– 56,000
,, Australia	68,000	56,000	– 12,000
,, New Zealand	31,000	20,000	– 11,000
,, British South Africa ...	18,000	14,000	– 4,000
,, Mexico	34,000	32,000	– 2,000
Insulated wire and cable, iron or steel—			
Total	398,000	268,000	– 130,000
To Canada	11,000	10,000	– 1,000
,, Mexico	60,000	47,000	– 13,000
,, Cuba	45,000	34,000	– 11,000
,, Brazil	11,000	19,000	+ 8,000
,, Japan	4,000	8,000	+ 4,000
,, Venezuela	34,000	9,000	– 25,000
,, Philippine Islands ...	37,000	18,000	– 19,000
Insulated wire and cable, copper—			
Total	3,896,000	4,900,000	+1,004,000
To Great Britain	456,000	617,000	+ 161,000
,, Canada	405,000	543,000	+ 138,000
,, Mexico	306,000	488,000	+ 182,000
,, Cuba	942,000	824,000	– 118,000
,, Brazil	360,000	438,000	+ 78,000
,, Chile	267,000	211,000	– 56,000
,, China	36,000	198,000	+ 162,000
,, Japan	35,000	41,000	+ 6,000
,, Philippine Islands ...	169,000	169,000	—
,, Australia	101,000	162,000	+ 61,000
,, Colombia	86,000	117,000	+ 31,000
,, New Zealand	68,000	80,000	+ 12,000

	1924. $	1925. $	Inc. or dec. $
Batteries, flashlight—			
Total	893,000	1,214,000	+ 321,000
To Mexico	134,000	134,000	—
,, Argentina	203,000	189,000	– 14,000
,, India	75,000	185,000	+ 110,000
,, Philippine Islands ...	91,000	153,000	+ 62,000
Batteries, other primary—			
Total	818,000	1,203,000	+ 385,000
To Norway	6,000	16,000	+ 10,000
,, Great Britain	75,000	117,000	+ 42,000
,, Canada	10,000	18,000	+ 8,000
,, Argentina	124,000	214,000	+ 90,000
,, Chile	21,000	39,000	+ 18,000
,, China	25,000	20,000	– 5,000
,, Australia	82,000	168,000	+ 86,000
,, New Zealand	31,000	40,000	+ 9,000
,, British India	12,000	23,000	+ 11,000
,, Brazil	43,000	78,000	+ 35,000
,, Mexico	100,000	110,000	+ 10,000
,, Spain	13,000	8,000	– 5,000
Batteries, storage—			
Total	2,883,000	2,683,000	– 200,000
To Denmark	135,000	59,000	– 76,000
,, France	8,000	5,000	– 3,000
,, Great Britain	197,000	163,000	– 34,000
,, Canada	327,000	213,000	– 114,000
,, Mexico	99,000	159,000	+ 60,000
,, Argentina	348,000	403,000	+ 55,000
,, Brazil	225,000	181,000	– 44,000
,, India	117,000	101,000	– 16,000
,, Australia	238,000	272,000	+ 34,000
Metal conduit, outlet and switch boxes—			
Total	574,000	797,000	+ 223,000
Telegraph apparatus—			
Total	516,000	497,000	– 19,000
To Great Britain	43,000	55,000	+ 12,000
,, Cuba	15,000	14,000	– 1,000
,, Canada	156,000	127,000	– 29,000
,, Japan	140,000	43,000	– 97,000
,, Argentina	5,000	6,000	+ 1,000
Radio apparatus—			
Total	6,031,000	9,904,000	+3,873,000
To Poland	6,000	2,000	– 4,000
,, Great Britain	142,000	645,000	+ 503,000
,, Canada	2,414,000	3,683,000	+1,269,000
,, Argentina	292,000	409,000	+ 117,000
,, Cuba	103,000	84,000	– 19,000
,, Mexico	394,000	272,000	– 122,000
,, Sweden	132,000	122,000	– 10,000
,, Australia	1,053,000	675,000	– 378,000
,, Japan	358,000	2,216,000	+1,858,000
Telephones, magneto—			
Total	183,000	125,000	– 58,000
To Great Britain	1,000	1,000	—
,, Canada	6,000	5,000	– 1,000
,, Cuba	23,000	5,000	– 18,000
,, Colombia	9,000	5,000	– 4,000
,, Australia	41,000	22,000	– 19,000
,, Brazil	25,000	22,000	– 3,000
Telephones, other—			
Total	543,000	498,000	– 45,000
To Canada	112,000	63,000	– 49,000
,, Mexico	17,000	12,000	– 5,000
,, Cuba	41,000	65,000	+ 24,000
,, Brazil	39,000	62,000	+ 23,000
,, Australia	91,000	10,000	– 81,000
,, New Zealand	5,000	19,000	+ 14,000
Magneto switchboards—			
Total	14,000	*	—
Other telephone switchboards—			
Total	1,147,000	799,000	– 348,000
Locomotives, electric railway—			
Total	1,923,000	482,000	–1,441,000
To France	14,000	—	– 14,000
,, Cuba	—	107,000	+ 107,000
,, Japan	167,000	52,000	– 115,000
,, Mexico	1,425,000	112,000	–1,313,000
,, Brazil	268,000	189,000	– 79,000
Locomotives, electric, mining and industrial—			
Total	320,000	331,000	+ 11,000
To Chile	45,000	96,000	+ 51,000
,, Japan	62,000	27,000	– 35,000
,, Mexico	27,000	44,000	+ 17,000
,, Australia	22,000	8,000	– 14,000
,, British South Africa ...	68,000	68,000	—
,, Canada	33,000	27,000	– 6,000

* Not separately distinguished.

Electrical Gifts for Christmas.—III.

Berry's Electric, Ltd., has many models of "Magicoal" fires which would be appropriate presents for this season. As an example we illustrate in fig. 22 the "Fireblaze," which combines the realistic glowing coal effect with a curved reflector, with excellent results. The fire is produced in brass and polished rustless steel. It has three separately-switched detachable fire bars, which can be had in any capacity from 600 to 1,500 W. Another appliance supplied by the same company is the "Restfulite" table standard. This comprises an emerald opal tilting shade mounted on a satin-brass finished standard, and has an overall height of 15 in. The "Restfulite" is shown in fig. 21.

The appliance depicted in fig. 26 is the "Patent Point" toaster produced by the Coventry Electrical Accessories, Ltd. It is constructed on very sound lines, the body being a single aluminium casting. The company also makes many other small domestic appliances suitable for presentation at Christmas.

Premier Electric Heaters, Ltd., has, in addition to its well-known fires, a good selection of other domestic electrical appliances. The principal feature of the kettle shown in fig. 25 is a device for switching off the current if the water boils away. The kettle is made in five sizes—from 1¼ to 6 pints—and each size is produced in polished or nickel-plated copper.

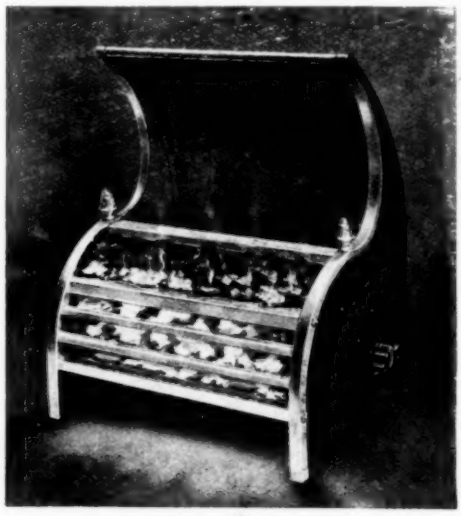


Fig. 22.—The "Fireblaze" Fire.

Fig. 23.—A "Miller" Table Standard.

Fig. 24.—"Universal" Curling Iron.

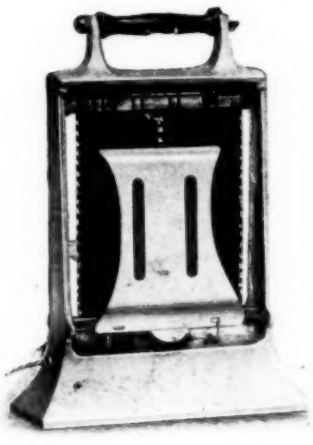


Fig. 26.—The "Patent Point" Toaster.

Fig. 27.—A Tea-ball Teapot.

Fig. 28.—The "Universal" Table Stove.

Fig. 30.—A "Universal-Voltage Saucepan.

Fig. 25.—The "Premier" Safety Kettle.

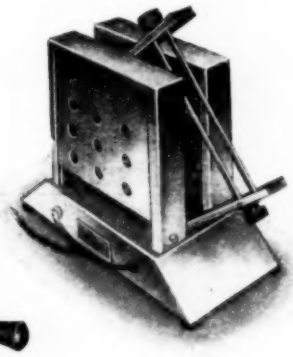


Fig. 29.—The "Deluxe" Toaster.

Fig. 31.—A "Premier" Multi-purpose Heater.

If desired, the appliance can be supplied without the safety device. Another "Premier" utensil is the universal-voltage saucepan illustrated in fig. 30. This is made in 1- and 2-pint sizes, and is nickel-plated inside and out. Full directions are given on the connector as to its correct position on the terminals. The voltage ranges are 100/125 and 200/250.

Another useful appliance supplied by this company is the multi-purpose heated illustrated in fig. 31. The picture shows the device in use as a small electric fire and as a fryer. It can also be employed for boiling a kettle, or, in conjunction with a small wire grid, as a toaster. The loading is 600 W and the heater weighs only 3¼ lb.

Messrs. L. G. Hawkins & Co., Ltd., have, as usual, a very comprehensive range of articles suiting all tastes and pockets. One useful appliance is the tea-ball teapot shown in fig. 27. This is fitted with a 420-W immersion element, and with a nickel-silver ball which, by means of a chain, can be lifted when the infusion process is complete. Fig. 28 shows a "Universal" table stove, which is of very neat appearance, being finished in nickel plate with an ebonised handle. Its glowing red coil elements enable toasting, frying, or boiling to be carried out expeditiously. Another "Universal" appliance is the curling-iron illustrated in fig. 24; this is provided with a hair-drying comb attachment. The standard depicted in fig. 23 is typical of a large range of "Miller" lighting fittings, which are beautifully decorated in numerous designs.

Speedy operation is the characteristic of the "Deluxe" toaster depicted in fig. 29. As will be seen, it is arranged so that both sides of the bread are toasted at once. As the loading is 1,000 W, it takes only a minute to toast each slice. The appliance has a polished nickel and aluminium finish. It is made by Electrical Utilities, Ltd.

Coal-Cutter Protection.

The New System of the Metropolitan-Vickers Electrical Co., Ltd.

IN our issue of February 5th last, p. 235, we briefly described a new system of coal-cutter protection which had been developed by the Metropolitan-Vickers Electrical Co., Ltd., and we are now able to give some constructional details of the actual apparatus employed.

The system is especially applicable to coal-cutters and coal-conveyors driven by directly-started squirrel-cage motors; it protects the trailing cables, prevents open sparking, and provides against injury to the operators and equipment. It also embodies characteristics which should result in reduced working costs and increased output.

The essential apparatus includes a special gate-end starting box, containing a main contactor equipped with protective and resetting devices, a control switch suitable for mounting in any type of coal-cutter, and a standard form of trailing cable fitted with suitable standard terminal plugs. Complete control of the gate-end device is effected by means of the controller on the coal-cutter. Important features of the system are that the control circuits work on a pressure not exceeding 20 V, and that no main circuit is made or broken in the controller. The supply is connected and interrupted only by the contactor in the gate-end box.

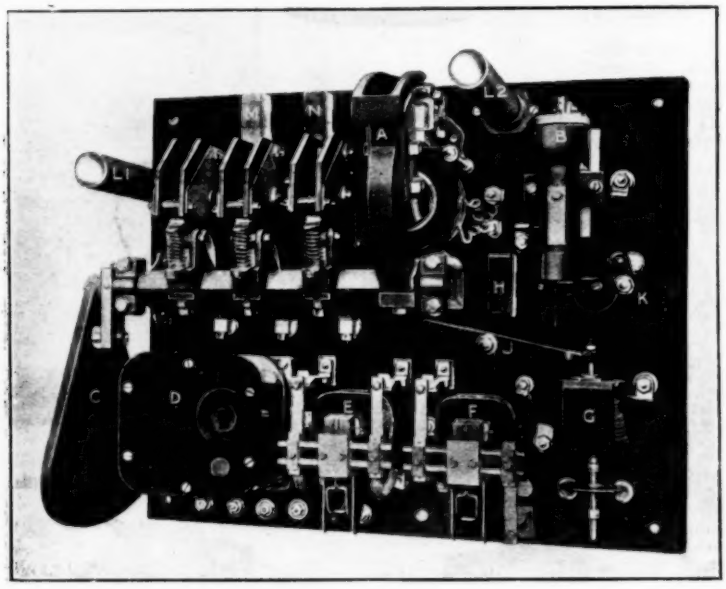


Fig. 1.—Starting Panel.

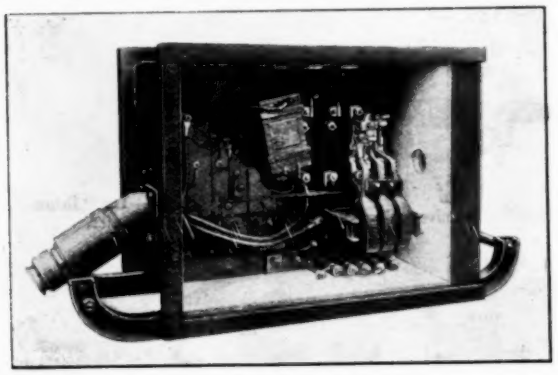


Fig. 2.—Gate-end Box, Back.

Fig. 1 shows the apparatus in the starter mounted on its panel. The power circuit to the motor is made and broken by the 125-amp., 3-pole, air-break contactor A, the magnetic blow-out coils of which are of the type used in rolling-mill control. It is claimed that the contactor may be operated two million times without attention. A bias weight C prevents the contactor from being closed by the gate-end box being overturned. The overload relay B has two windings connected in different phases, and also a time-lag which allows from four to five times the full-load current for five seconds for motor starting, and twice the full-load current for about 20 seconds to guard against the service being interrupted by a temporarily difficult cutting. Protection of the trailing cable and motor is completed by the leakage-trip relay D, which operates in the event of leakage from any phase to earth. The arcing relay G prevents the completion of the resetting of the control circuit until the current interruption at the main contactor is complete. A red signal lamp L1 indicates when the supply is connected to the gate-end starter, and a white lamp L2 indicates when the power is connected through to the motor. Fig. 2 shows the back view of the starter with the cover removed.

The containing box for the starter is of strong boiler plate and is fitted with terminal sockets for the incoming and outgoing cables. It is mounted on long skids which can be drilled for fixing standard tub wheels to facilitate its transport. Both the front and back covers of the box slide in deep machined grooves, giving it a flameproof construction while allowing for easy access to the interior. Arrangements have also been made whereby a specially designed isolating switch can be fitted between the incoming cable box and the body of the tank. This switch will isolate all parts within the starting box, so as to avoid any risk of shock from accidental contact with the live metal, and is interlocked mechanically with the covers so that at the front and back these cannot be withdrawn except with the switch in the open position, and must be properly replaced before the switch can be closed. The inclusion of the isolating switch is strongly recommended.

The controller for the starter is designed to fit into the controller chamber of any coal-cutter, but in cases where this compartment is not of flameproof construction it is supplied in a flameproof case, as shown in fig. 3. It consists of a single drum-type switch having three positions, forward, off, and reverse. The motor cannot be started except by means of this controller, no operation being possible from the gate-end box except to trip the contactor in such an emergency as the interruption of communication by a roof fall.

The power and control lines are included in a 5-core trailing cable, three cores being used for the power circuit, one for earthing, and one for the pilot circuit.

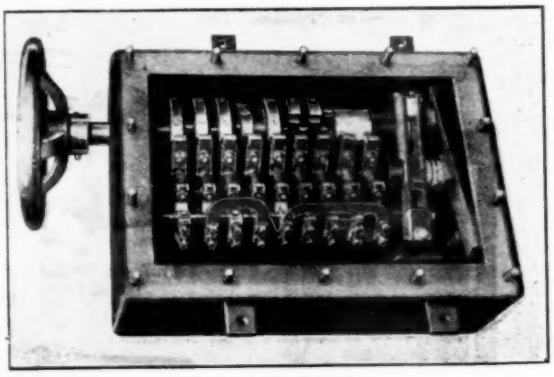


Fig. 3.—The Controller.

As the power connection depends on an efficient connection between the case of the coal-cutter and that of the gate-end

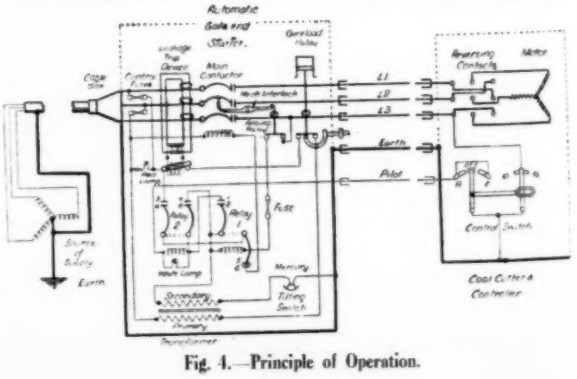


Fig. 4.—Principle of Operation.

starter, the external casings of the apparatus cannot rise above earth potential, provided, of course, that the gate-end starter case is effectively earthed.

The system also obviates the possibility of accident due to unexpected starting, for after a stoppage due to overload, low voltage, or failure of supply, the cutter will not restart when the supply is restored, even though the switch handle may have been left in a running position; it must first be returned to the off position and the controller operated in the correct sequence. The no-volt release and leakage trip operate instantaneously, and the latter can be adjusted to operate down to 5 per cent. of the full-load current of the motor. After tripping the relay remains latched out and prevents a restart until it is released by an authorised person. It is claimed that the system also effects important improvements in working efficiency; increased output is obtained by the facility of resetting the overload and no-volt trips from the coal-cutter, as it is not necessary for the operator to walk back to the gate-end switch for this purpose.

Fig. 4 represents the principle of the operation of the system. The main power circuit passes from the incoming cable box on the gate-end starter, round the leakage trip device to the main contactor, one lead passing round the arcing and overload relays, and the three power cores L1, L2, and L3 leading *via* the reversing contacts on the coal cutter control switch to the motor. Control circuit No. 1 passes from the incoming lines L1 and L2 through the control fuses shown adjacent to the cable box, the contacts of the leakage trip device, the contacts of the overload relay, and the transformer primary. Control circuit No. 2 passes from the transformer secondary through the tilting switch to the starter-box case, the earth core to the coal cutter case, the auxiliary contacts shown to the right of the control switch to the power core L3, through the contacts of the arcing relay and a fuse to the operating coil of the off position re-set relay No. 1, and back to the transformer secondary. No. 3 control circuit passes from the transformer secondary, through the contacts 1 and 2 of relay 1, the operating coil of relay 2, the pilot core to contacts R or F of the controller, the case of the coal cutter and the earth core to the case of the gate-end switch, and thence through the tilting switch back to the transformer secondary.

The Progress of "Wireless," 1919-26.

By Prof. C. L. FORTESCUE, O.B.E., M.I.E.E.

(*Abstract of Chairman's Address to the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page 934.*)

The Transmitting Medium.

OTHER effects are now known to be involved besides the refraction of the upper atmosphere. Waves starting from a radiating aerial tangential to the surface of the earth are accompanied by currents in the conducting surface and a consequent wastage of energy, which increases with increase of the frequency. In addition, those rays starting tangentially are subject to some degree of true diffraction, the amount becoming less and less as the wave-length decreases.

The combined effect of all these factors is that with long waves the intensity of the direct rays following the surface of the earth does not fall off much more rapidly than the natural decrease to be expected from the increasing circumference of the wave front. At the same time, the upward rays are quickly refracted back to the earth, and the actual intensity there is that due to the superposition of the direct and refracted rays. The lengths of the paths of these two rays are different, and the observation of interference effects from long-wave stations is due to this fact. With wave-lengths in the neighbourhood of 10,000 metres and at distances of from 100 to 1,000 miles, there are undoubtedly zones of high and low resultant field strengths, the positions of which do not vary greatly from hour to hour or day to day. For longer distances the resultant field arises from the superposition of a number of multiple refracted and reflected rays, and the interference effects become complicated and variable. As far as actual dissipation of the energy is concerned, this takes place at every reflection at the earth's surface, and there is the possibility that at each refraction in the upper atmosphere a part of the energy is scattered into space. It is interesting to note that if this actually occurs with the radiation from the aerials now commonly in use, the form of the exponential term in the Austin-Cohen relationship requires that it shall be proportional to the intensity of the refracted wave and inversely proportional to the wave-length.

Considering now the behaviour of progressively shorter waves, the direct ray tends to die out more and more rapidly and the refracted waves tend to return to the earth's surface at greater and greater distances, but without loss of energy other than that possibly associated with the initial refraction. At a wave-length of about 50 metres a state is reached where overland the direct ray falls to an unobservably small magnitude before the first of the refractive rays returns to the earth's surface and the phenomenon of "skip distance" appears. Further decrease of wave-length increases the "skip distance" at both ends, and eventually at a wave-length somewhere below 5 metres the direct ray dies out very quickly (at any rate over land), and under normal conditions of ionisation the indirect ray apparently never returns to the earth at all. According to this theory the efficiency of short-wave transmission is attributable to the path of the refracted rays being just sufficiently bent for some of them to come back to the earth for the first time at the receiving station. This bending is dependent upon the extent of the ionisation, and so the efficiency is necessarily accompanied by high sensitivity to changes in the distribution of the electronic clouds. If these are unusually dense on account of sunspots or other phenomena, the rays appear to be bent back too soon and to dissipate their energy on the surface of the earth. If the ionisation is below normal, the rays apparently proceed in spherical paths of ever-increasing radius and are dissipated in space. So far as present knowledge goes, therefore, short-wave transmission must always be subject to marked fading effects.

The whole subject of the bending of wireless waves is happily one in which the mathematical physicist, the geophysicist, and the wireless engineer are closely collaborating, and there is little doubt but that this combined effort will lead to more accurate knowledge, which will be of great importance both in determining the allocation of wave-lengths for the various wireless services, and in drawing up weather forecasts.

Reception.

Receiving stations and instruments have been improved, but there has not been any great innovation. The very long Beverage aerial is under trial and appears to give good results in spite of the fact that the theory of its action is still rather uncertain. The commonly accepted explanation is that there is an e.m.f. tending to set up standing waves in the horizontal aerial wire, which is generated by a horizontal component of the electric field of the incoming electromagnetic waves; therefore, no signals would be received if the wave-front were vertical. It remains a fact, however, that when such a wave is advancing along the aerial, points half a wave-length apart are at different potentials with respect to the earth and it is not obvious why these differences of potential do not themselves set up standing waves such as those actually found in practice.

Selectivity is still dependent upon a balance between positive and negative reactance, the necessary inductances and capacities being commonly associated with the high-frequency amplifying stages. This arrangement gives a high degree of selectivity without the necessity of very exact tuning of any one circuit. The resonance curve is, however, of the same form as that of a single circuit of very low resistance and when a departure from this type of curve is necessary the inductances and capacities have to be used as filters, the ideal of the flat-topped curve with very steep sides being more nearly approached as the number of circuits is increased. The design of the selective components of the receiving circuit is now made dependent upon the width of the band of frequency of incoming waves from which energy is to be absorbed. At the edges of the band the cut-off can be very sharp and the ideal telephone receiver would undoubtedly employ filter circuits or their equivalent.

There has been no extensive change in either the practical or theoretical aspects of amplification. The desirability of balancing each individual stage of amplification by reverse capacity coupling (long advocated by some workers with high-power amplifiers) is now being adopted to some extent. An alternative method of dealing with this problem, by designing a valve with an earthed screen between the controlling grid and the anode, has been tried; first suggested in this country, it is believed, by Mr. H. A. Madge in 1926, it involves a new principle, namely, the deliberate use of the inertia of the moving electrons. Valves have now been constructed in which the screening is so complete that the effective grid-anode capacity is only a few hundredths of a micro-micro-farad; these valves have a high equivalent internal resistance and a very high equivalent grid-closeness factor. Remarkable results have been obtained, but it does not appear that all possibilities of parasitic oscillation are eliminated.

Atmospheric interference still imposes the lower limit to signal strength for satisfactory reception. The work of Messrs. Watson-Watt and Appleton under the auspices of the Radio Research Board has shown that the earlier conclusions with regard to the nature of atmospheric interference were correct. So far as present knowledge goes, no limiting devices can effect any considerable change in the signal-shock ratio; hence, suitable choice of site and the use of directional aerials are the only alternative possible to increase the power of the transmitter. How far this process can be carried is a matter requir-

ing the urgent attention of the authorities responsible for the control of the large stations throughout the world. It is a well-established fact that atmospherics do not seriously interfere with short-wave reception.

Small Thermionic Valves.

The manufacture of small receiving valves has so developed that the possible production in Europe and America is now at least one hundred times greater than it was in 1919. This result is not due merely to multiplication of manufacturing facilities, but is mainly attributable to the adoption of improved methods, amongst which the greatest factor is probably the use of chemical means for absorbing the last traces of gas after sealing-off from the vacuum pumps. This reduces the time necessary for pumping and avoids the risk of damaging the filament by positive bombardment. Low-temperature filaments are almost universally used, with the result that a life of 10,000 hours is now a matter of routine experience; in fact, the probable life of some of the valves on sale at the present time cannot be stated because sufficient time has not yet elapsed since the current manufacturing processes were introduced! The greatly reduced power consumption of the modern filament is perhaps even more important than its life, but in spite of these improvements there is every reason to expect further developments in the design of receiving valves. The advantages of low internal resistance have scarcely been realised yet, and for many purposes further reduction is desirable.

Loud-Speakers.

An enormous amount of work has been done on loud-speakers in the last few years, but it is apparently a fact that there is no loud-speaker in existence that will give a true rendering of both speech and music; none gives a uniform response over the whole range, and it is a serious reflection on the ingenuity of our profession that this should be the case.

Radio-Frequency Measurements.

The most important high-frequency measurement has always been that of the frequency itself and an accuracy in the absolute measurement of about one part in one hundred thousand has become achievable since it has been possible to base the measurements on the standard clock at the National Physical Laboratory.

This standard of accuracy is by no means in excess of that required in practice. It has become necessary either to adjust stations to identical frequency by means of a central receiving station employing heterodyne reception and tuning forks, or to provide some form of wavemeter to enable the frequency of each station to be adjusted independently, so that the difference from the reputed frequency is, at the most, 50 cycles. The second method is undoubtedly preferable, but the technical problem involved is of no mean order, and a solution has only become possible by the development of the quartz crystal resonator.

The measurement of capacity, inductance, and resistance is still complicated by the difficulty of defining the quantities themselves in those cases usually met with in practice wherein the distributed capacities are appreciable. The whole range of measurement at frequencies in the neighbourhood of fifteen millions (20-metre waves), other than that of the frequency itself, is as yet to all intents and purposes unexplored.

Broadcast Radio-Telephony.

In 1919 the full possibilities of broadcasting were certainly not recognised. A new industry of no small dimensions is now devoted solely to the manufacture of apparatus for broadcast reception. The British Broadcasting Company is to be replaced next year by a Chartered Corporation. The Company has rendered great public service and has established traditions which must not be cast lightly aside. The new controlling body must have sufficient standing to conduct international negotiations on broadcasting matters, and in order that it shall have this standing it must have some direct relation to the Government. When, two years ago, broadcast listeners down the eastern seaboard of America demanded the restriction of wireless services to ships, it was felt to be absurd that a mere luxury should be given serious consideration when established commercial services were concerned. To-day, however, views have changed and the fact that one person electing to send an unimportant message from a ship in the English Channel can seriously interfere with the pleasure of hundreds of other people—and might possibly prevent an important Government pronouncement from being received by thousands of people for whom it is intended—has led to the conclusion that steps must be taken internationally to reduce interference between the commercial and broadcasting services to something much below that now experienced round some of our coasts. It is purely a financial question, and it may be that the only fair solution is that some of the income from the broadcasting licences should be devoted to the improvement of ships' installations.

Automatic Telephony.

An Outline of the "Trunking" Aspect.

By G. F. O'DELL, B.Sc., M.I.E.E.

(A Review of a Paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

BROADLY, "trunking" may be defined as that branch of telephony which has for its origin all those problems that arise when more than one call has to be provided for at one time. When the instruments are in one building, or, at any rate, very close together, this may be done by means of intercommunication systems, but in the general case they are connected to central exchanges, the latter themselves being connected with one another by junction lines. In the smallest exchanges sufficient plant is provided to allow all subscribers to be using their telephones at once. Thus, on single-cord boards, each subscriber's line is terminated in a cord and a jack, and as many conversations may take place simultaneously as there are pairs of subscribers; but in larger exchanges, generally speaking, only a small proportion of subscribers wish to use their telephones at any one time. It follows that the economics of the industry would have been vastly different if the average subscriber had been other than a small user. This phase of telephony has never been sufficiently emphasised in the literature of the subject. Tacitly it is presumed that a multiplication of circuits is all that is required to enable all subscribers who wish to make calls to do so. Regarded purely as a physical possibility, this is probably true; as an economic possibility, however, it is certainly not true, because the cost of providing service on these lines would be prohibitive.

The branch of automatic telephony called trunking may be defined as the method of calculating the amount of switching plant (internal and external) required to carry the traffic under all the various conditions occurring in practice; to provide, arrange, and cable this plant in such a way that not only is its traffic capacity a maximum, but that it can readily be extended or re-arranged as the traffic conditions change. As a corollary it includes the measurement of traffic and traffic overflow, and is also concerned with subsidiary but very important matters, such as the tracing of calls through an exchange, and the provision of records showing the amount and arrangement of the switching plant.

It is the object of this paper to say something about most of these phases of trunking and especially to describe the way in which trunking problems have been handled by the British Post Office, and the present practice of its Telephone Department.

Following the investigation of the ideas "traffic unit" and "grade of service" in some detail, the history of trunking is touched briefly, this section terminating with a description of the means provided in modern exchanges for connecting one rank of switches with another. It is announced that in future exchanges, particularly those in London, a centralised link-distributing frame will be provided which is described as representing the high-water mark of development in trunking facility; it affords a ready means of making almost any change desired, and is said to represent a great advance on its predecessors. But such flexibility has to be paid for, and it has been felt by some engineers that the cost of bringing all the inter-switch cabling to one central point is too high a price to pay for the flexibility gained. In order to reduce this cost and yet to retain the chief advantages of the link frame, an improved type of terminal assembly has been evolved, which will be called the "link frame terminal assembly." As it is located, like the older terminal assemblies, at the end of the selector boards, it is economical in cable. Its design, however, follows that of the link frame as closely as its situation and somewhat confined space will permit.

The traffic-carrying capacity of switches under the "full availability" condition leads to the consideration of the possible methods of trunking when the availability is "limited"; the particular method called "grading" is described in detail and the traffic capacity of various arrangements is investigated. The principle is the allocation of certain switches as the first choices of one group of switches of the preceding rank, and of others as later choices from several groups. The best effect of grading of the type described is only obtained if, first, it is "smooth," and, secondly, the number of groups is so chosen that the number of outlets does not exceed half the maximum possible number, and it has been assumed that grading can only produce the best effect if so designed that indivdual switches are tested first and commons last. Test figures show that the loss is appreciably greater when grading is tested in the reverse order.

The effect of changes in the distribution of traffic is next considered, and then information is collected regarding the design curves used by the Post Office engineers, six in number. The paper terminates with a description of the methods adopted by the P.O. authorities for measuring traffic and traffic overflow, and of the use made of such measurements.

Discussion in London.

The author was complimented on the high standard of the paper, and attention was drawn to the importance of the duration of a call in an automatic exchange; it was very different from that in a manual system, and because of that fact the traffic metering arrangements described in the paper were considered disappointing. It was not desired to add to the complication of the system, but it was desirable to record the duration of calls, or the "traffic units," and not the number of calls. The author pointed out that "traffic units" could be quite easily measured, if required, by means of the devices mentioned in his paper, although he agreed that more could be done in this direction.

How was traffic loss measured? There were three possible ways: (*a*) to build the exchange first and measure the loss afterwards; (*b*) by mathematical means; and (*c*) by simulating exchange conditions artificially. Could anything be done graphically? One speaker thought so, and outlined a method, of which the author was, however, sceptical; he thought it similar to a graphical system that had been used in Germany, and also to one suggested by a Japanese engineer who had studied in this country.

It was pointed out that the "line finder," an alternative to the pre-selector, had not been mentioned in the paper. In reply to a request for details about the manner of producing artificial traffic for the purpose of testing grading, Mr. O'Dell explained that all such tests had been confirmed later by actual exchange records. A speaker who depreciated efforts that were made to economise traffic channels favoured liberalism in that respect, asserting that they should cater for the maximum, not average, conditions. His experience of a railway company's automatic exchange indicated that the system would be judged, not by its average performance, but by the manner in which it functioned during emergency demands. The author could not agree that provision should be made for the maximum traffic, because the public would not be prepared to pay for that. Speaking as a user, he was quite satisfied with a loss of one call in 500, and would not be prepared to pay a higher rental for a slight improvement of that ratio.

New Electrical Proposals for Parliament to Consider.

We publish below a list of proposals that will come forward in the next session of Parliament (1927). Readers who are desirous of obtaining further information will find the notices published in full in the *London Gazette* for November 19th, 23rd and 26th.

(a) Electric Light and Power.

North Metropolitan Electric Power Supply Co.—Powers to raise additional capital, additional borrowing powers, &c.

Farnham Gas and Electricity Co.—Further powers in connection with the electricity undertaking, powers to raise additional capital, additional borrowing powers, &c.

Mountain Ash Urban District Council.—Further powers in connection with the electricity undertaking, including the sale of electrical apparatus let on hire, provision of showrooms, offices, &c.

West Bromwich Corporation.—Powers to alter and extend the boundaries of the borough so as to include part of the urban district of Perry Barr, to extend the limits for the supply of electricity so as to include the added area and to exclude the added area from the South-West Midlands Electricity District and from the area of supply of the Shropshire, Worcestershire and Staffordshire Electric Power Co., and to include such area in the West Midlands Electricity District, powers to purchase certain portions of the tramways of the South Staffordshire Tramways Co., Ltd., the South Staffordshire Tramways (Lessee) Co., Ltd., and the Birmingham District Power and Traction Co., Ltd., provisions with regard to the working of the said portions of tramways when acquired, powers to provide, maintain and run trolley vehicles, powers to abandon and discontinue certain tramways and substitute trolley vehicles, powers to provide and run motor omnibuses, and further financial powers.

Swansea Corporation.—Further borrowing powers with regard to the electricity and tramway undertakings.

Liverpool Corporation.—Powers to extend the City so as to include therein the parishes of Croxteth Park and West Derby Rural in the rural district of Sefton, in the County of Lancaster, and to exclude the added area from the administrative County of Lancaster, and from the jurisdiction of and representation upon the Lancashire County Council and the Sefton Rural District Council, and to abolish the West Derby Rural Parish Council, powers to extend the Corporation's limits for the supply of electricity so as to include the added area, powers to construct additional tramways, powers to include the urban district of Little Crosby within the limits for the supply of electricity by the Corporation, to transfer to the Corporation the undertaking of the Hightown Electricity Co., and further powers in connection with the electricity undertaking, &c., construction of new tramways, &c.

Bognor Gas, Light and Coke Co.—Extension of limits within which the company is authorised to supply electricity so as to include the borough of Arundel, the parishes of Ford, Climping and Tortington in the rural district of East Preston, the parishes of Middleton, Walberton, Binstead, Fartham Slindon, Madehurst, Upwaltham, Boxgrove and Tangmere, in the rural district of Westhampnett, all in the County of West Sussex.

County of London Electric Supply Co., Ltd.—Extension of the area of supply, power to supply electricity in bulk, or for power, lighting, cooking, or other domestic purposes, in an area consisting of the County of Essex, powers to construct sub-stations, transforming stations, &c., powers to acquire by agreement undertakings of other undertakers, &c., provisions as to rights of purchase or re-purchase by local authorities of undertakings so acquired, postponement of date for compulsory purchase, &c.

Thorne Colliery Railway and Wharf.—Messrs. Pease and Partners, Ltd., are applying for powers to construct a railway, 6¼ miles long, from Thorne Colliery to a point in the urban district of Goole, to provide an overhead conveyor, pier or wharf, &c., powers to work the intended works and appliances provided in connection therewith, by steam or electrical power generated at Thorne Colliery.

London and Home Counties Joint Electricity Authority.—Powers to acquire lands, &c., in the urban district of Chiswick, in the county of Middlesex, and to construct and maintain a station or stations for generating and transforming electricity, &c.

Grimsby Corporation.—Extension of limits within which the Corporation is authorised to supply electricity so as to include the parishes of Weelsby, Humberstone, Irby, Beelsby, Barnoldby-le-beck, Hatcliffe, Brigsley, West Ravendale, East Ravendale, Ashby-cum-Fenby, Wold Newton, Hawerby-cum-Beesby, in the rural district of Grimsby; the parishes of North Killingholme and South Killingholme, in the rural district of Glanford-Brigg; the parishes of Brocklesby, Keelby, Riby and Swinhope, in the rural district of Caistor and the rural district of Louth. Provision, equipment and working of trolley vehicles, abandonment where and when necessary of certain tramways, powers to run omnibuses within the borough, further financial powers, &c.

Wessex Electricity.—Incorporation of a company for the purpose of generating and supplying electricity within the following area, namely:—

The administrative county of Oxford, except the borough of Henley-on-Thames, the urban district of Thame, the parishes of Kingsey, Ermington and Chinnor, in the rural district of Thame, the parishes of Badgemore, Rotherfield Greys, Rotherfield Peppard, Harpsden, Shiplake, Eye and Dunsden Liberty and Kidmore End, in the rural district of Henley, and the parishes of Mapledurham and Whitchurch, in the rural district of Goring.

In the administrative county of Buckingham, the parishes of Radnage, Stokenchurch, Ibstone, Turville, Fingest, and Great Marlow, in the rural district of Wycombe, and the parishes of Fawley, Hambleden and Medmenham, in the rural district of Hambleden.

The administrative county of Berks., except the parishes of Pangbourne, Tilehurst and Theale, in the rural district of Bradfield, and so much of the county as lies to the east of the remainder of that district.

In the administrative county of Southampton, the boroughs of Andover and Basingstoke, the rural districts of Basingstoke, Kingsclere, Whitchurch and Andover, and the rural district of Hartley Wintney, except the parishes of Yateley, Hawley, Cover and Crookham.

The administrative county of Wilts, except the city of New Sarum, the borough of Wilton, and the rural districts of Mere, Tisbury, Wilton and Salisbury.

In the administrative county of Gloucester, the urban districts of Tetbury and Cirencester, the rural districts of Tetbury, Cirencester, and Northleach, and the parishes of Great Barrington, Little Barrington, Great Rissington, Little Rissington, Clapton, Bourton-on-the-Water, Wyck Rissington, Westcote, Icomb, Church Icomb and Bleddington, in the rural district of Stow-in-the-Wold. Supply of electricity in certain cases beyond or for use beyond area of supply. Supply of electricity in bulk by and to adjoining authorised undertakers, provision, sale, letting for hire, &c., of fittings and apparatus, future purchase by Joint Electricity Authority, &c.

Yorkshire Electric Power Co.—Powers to increase capital, additional borrowing powers, powers to supply electricity in bulk.

Birkenhead Corporation.—Powers to extend the Corporation's limits for the supply of electricity so as to include the townships of Woodchurch, Arrowe, Laudican, Storeton and Thingwall, and to repeal the powers of the District Council to supply electricity therein, further financial powers, &c.

East Anglian Electric Supply Co., Ltd.—Powers to supply electricity for public and private purposes in an area comprising the geographical counties of Norfolk, Suffolk and Essex (including the county boroughs therein), except so much of Essex as lies on the westerly, south-westerly, and southern sides of a line commencing at the point where the boundary between the rural districts of Dunmow and Epping joins the boundary between Essex and Hertfordshire, passing along the boundary between the said rural districts, the westerly and southern boundaries of the rural district of Ongar, and the westerly and southern boundaries of the rural district of Billericay, to the point where it meets the boundary of the rural district of Rochford, and thence following in a southerly direction the western boundary of the last-mentioned district to the centre of the Thames, &c.

Salford Corporation.—Further powers with reference to the electricity and tramway undertakings, powers to run omnibuses wholly or partly outside the city.

Bedford Corporation.—Further provisions with regard to the electricity undertaking, additional financial powers, &c.

Buxton Corporation.—Further powers with regard to the electricity undertaking, including the sale by the Corporation of fittings and the wiring of houses by it, provision of showrooms, further financial powers, &c.

Croydon Corporation.—Extension of the boundary of the borough and parish of Croydon so as to include the parish of Addington, in the rural district of Godstone, the extension of the area of supply of electricity to include the added area, the acquisition by the Corporation of the undertaking and works of the County of London Electric Supply Co., Ltd., in the existing parish of Addington; further provisions with regard to the electricity undertaking, including the sale of electrical fittings and the wiring of houses by the Corporation, establishment of showrooms, &c.

Manchester Corporation.—Extension of the boundaries of the city and township, &c., of Manchester so as to include the township of Northenden, Northern Etchells, and Baguley, in the Bucklow rural district in Cheshire, powers to include the added area within the area of supply of electricity, power to acquire the undertaking of the Altrincham Electric Supply, Ltd., in that area, further financial powers, &c.

Derby Corporation.—Extension of the borough to include the urban district of Alvaston and Boulton and the parishes of Allestree, Markeaton, Mickleover, Breadsall, Chaddesden, Elvaston, Littleover, Normanton, Sinfin and Arleston, Sinfin Moor, and Spendon, in the Belper, Repton and Shardlow rural districts in Derbyshire, powers to construct new tramways, run omnibuses outside the borough, &c.

Sunderland Corporation.—Powers to extend the borough so as to include therein the urban district of Southwick, the parishes of Fulwell, Ford and Bishopswearmouth Without (including Bishopswearmouth Without detached) and parts of the parishes of Tunstall and Ryhope, in the rural district of Sunderland, part of the parish of Whitburn, in the rural district of South Shields, and part of the parish of Silksworth, in the rural district of Houghton-le-Spring, all in the county of Durham, provisions for saving the rights of the Cleveland and County of Durham Electric Power Co. in the added area, further powers with regard to the electricity undertaking, powers to provide and run motor omnibuses within the borough and the added area, further provisions with regard to the Corporation tramways, &c.

Leeds Corporation.—Powers to extend the boundary of the city to include the urban district of Gildersome, the townships of Templenewsam, Alwoodley and Eccup, and the township of Austhorpe (except the detached part thereof), the inclusion of the added areas within the Corporation area of supply of electricity, and the acquisition by the Corporation of the Yorkshire Electric Power Co., and the Electrical Distribution of Yorkshire, Ltd., in the added areas, further financial provisions of the undertakings, and powers to run omnibuses along routes outside the city where trolley vehicles are authorised.

Fleetwood Urban District Council.—Further powers with regard to the electricity undertaking.

Coventry Corporation.—Alteration and extension of the boundary of the city and parish of Coventry so as to include the rural district of Coventry, the parishes of Bedworth, Exhall, Foleshill, Stoke, Stoke Heath and Wyken, and parts of the parishes of Walsgrove-on-Sowe, Benley and Keresley, in the rural district of Foleshill, parts of the parishes of Coundon, Allesley, and Berkswell, in the rural district of Meriden and the parish of Stevechall and part of the parish of Stoneleigh, in the rural district of Warwick, provisions for saving the rights of the Leicestershire and Warwickshire Electric Power Co. in certain parts of the added areas, and for the modification of its rights and powers in other parts of the added area, provision with respect to the supply of electricity in the added areas, further financial provisions, &c. Powers to extend the area of supply of electricity so as to include therein the parishes of Binley, Keresley, Stoke Heath, Walsgrave-on-Sowe, Willenhall, and Wyken, in the rural district of Foleshill, the parishes of Allesley, Berkswell and Coundon, in the rural district of Meriden, and the parish of Baignton, and so much of the parish of Stoneleigh as is not already within the Corporation's area of supply, in the rural district of Warwick, further financial powers, construction of new tramways.

Birmingham Corporation.—Extension of the City so as to include the urban district of Perry Barr, provision for the supply by the Corporation of electricity in the added area, and the repeal of the powers of the Shropshire, Worcestershire and Staffordshire Electric Power Co. in relation to that area.

(b) Electric Tramway, Motor-'bus and Trolley Vehicles.

Bury Corporation.—Powers to run omnibuses within and beyond the borough; further provisions with regard to the existing tramways, financial provisions, &c.

London County Council.—Powers to reconstruct tramways in Whitechapel, High Street and streets adjacent thereto, extension of time for completion of certain tramways already authorised.

Hastings and District Tramways Co., Ltd.—Powers to provide and run trolley vehicles by electrical power supplied by means of overhead equipment on routes in the county borough of Hastings and borough of Bexhill, on which the company has constructed or is authorised to construct tramways or light railways, powers to discontinue and abandon, wholly or partly, existing tramways and light railways of the company, and to substitute trolley vehicles for services of cars on the routes thereof, powers to adapt, erect and construct overhead equipment for working of trolley vehicles.

Aberdare Urban District Council.—Powers to abandon the trolley vehicle undertaking of the Council or any part thereof, and to substitute motor omnibuses, to remove, sell and dispose of the overhead electrical and other equipment, powers to provide and run motor omnibuses within and without the district, powers to extend the limits of supply of electricity to parts of the parishes of Penderyn and Rhigos Hamlet, further powers with regard to the electricity undertaking, including the provision of showrooms and offices, the sale of electrical fittings let on hire, supply of electricity in bulk, &c.

Matlocks Urban District Council.—Further powers, including reconstruction and equipment of the tramway undertaking for working by electrical or other mechanical power, and powers to maintain and run omnibuses within and without the district.

Newcastle-upon-Tyne Corporation.—Powers to run omnibuses, powers to discontinue the tramways belonging to the Corporation, and to run omnibuses along the route of any tramway so discontinued or abandoned.

Colchester Corporation.—Powers to provide, equip and work trolley vehicles, abandonment or discontinuance of certain tramways rendered unnecessary, further powers with regard to the tramway undertaking, powers to run omnibuses within and outside the borough, and further financial powers.

Wallasey Corporation.—Powers to construct new tramways within the borough, powers to provide, equip and maintain trolley vehicles, and maintain and run omnibuses beyond the borough, powers to extend the boundary of the borough so as to include the township of Moreton and part of the township of Bidston-cum-Ford, both in the Wirral rural district. Powers to include the added area in the area of the Corporation for the supply of electricity, powers to acquire the rights, undertakings and works of the Hoylake Urban District Council, the Wirral Rural District Council, the Birkenhead Corporation, or any of them in relation to the supply of electricity in the added area, and to alter, amend or appeal the powers of those authorities in respect of such supplies in those areas; further provisions with regard to the electricity undertaking, additional financial powers, &c.

Bradford Corporation.—Powers to run trolley vehicles along certain routes within and without the city, provision of apparatus, &c., powers to run omnibuses within and without the city, financial provisions, &c.

Modern Shop Lighting.—Now that the coal restrictions have been removed, it has become possible to put into use the decorative lighting scheme that has been carried out at Messrs. Austin Reed's premises, Regent Street, London, the general lighting of which was described in our issue of November 12th. The building does not lend itself in any way to a lighting scheme, such as has been installed in a good many other London buildings, whilst the ground landlord's regulations did not permit of other schemes of outside lighting. The scheme adopted by Messrs. Tyler and Freeman consists of a small trough reflector of B.T.-H. make for every window; small curtains have been fitted on all the windows and blinds behind the windows, the trough reflectors being fixed at the bottom of the window, between the curtain and the blind. The effect is to give a very pleasing golden tone to the whole of the windows. If desired, a coloured effect can be obtained by fixing screens over the reflectors. The whole installation is entirely independent of the general lighting scheme of the building, and is controlled by independent time switches, so that the lighting or sections of it can be switched on and off as required. The scheme gives a distinctive character to the building, and is, we believe, quite novel. The work was carried out entirely to Mr. E. H. Freeman's own design under the instructions of the architects, Messrs. Westwood & Emberton.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

The Chaslyn Hydrometer.

We have received a sample of a new vent-type hydrometer from Messrs. J. H. Collie & Co., which should be an extremely useful appliance to all radio enthusiasts. It is a very inexpensive means of ascertaining the condition of accumulators, and very simple to use; it can be left permanently inserted in the battery during discharge. The device, which is only 3 in. in length overall, consists of a short glass tube which is inserted into the acid through the vent hole, as shown in fig. 1; the rubber bulb is squeezed and released sharply, so that acid

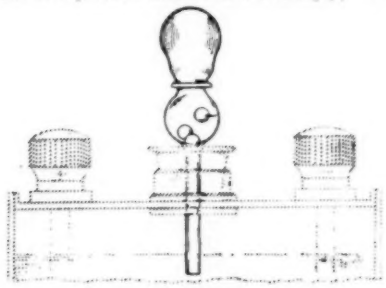
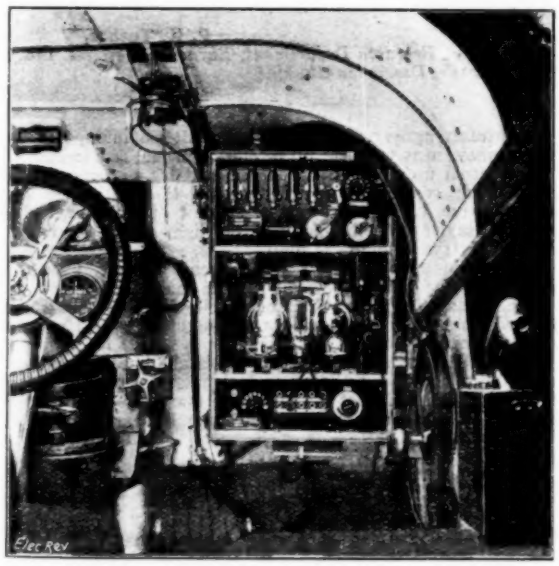


Fig. 1.—A Vent-type Hydrometer.

rises into the glass bulb, when it will be noticed that one or more of the small balls contained in the latter will float or sink. Each of the three balls is of a different colour, the specific gravity of each corresponding to a critical state of the battery and indicating as follows: When all the balls float, the cell is fully charged; when two only float, the cell is well charged; when one ball floats, the cell is half charged; and when all three sink, the cell is discharged.

The Air Route to India: Wireless Equipment.

DURING his recent flight to Australia Sir Alan Cobham emphasised the importance for long-distance commercial flying services of good ground organisation, wireless communication, and weather reports. These details are being very carefully organised in connection with the new air route to Egypt and India which will be opened by Imperial Airways, Ltd., at



Aerial coiled up on right hand. Transmitters and receiver in one box, remote controlled by switches fixed to roof.

Fig. 2.—Marconi AD 6 Wireless Equipment in Pilot's Cock-pit on Handley Page Aeroplane.

the beginning of next year. The DH-66 multiple engined aircraft which will fly on this route will be fitted with the latest type of Marconi 150-watt all-purpose telephone-telegraph aircraft equipment, Type AD 6, so that they may be in constant touch with ground stations throughout the journey.

These installations have been especially modified to suit the conditions existing on this new route. The most interesting development is the employment for the first time of a generator which provides power both for the internal and external lighting of the aeroplane and for the wireless installation. In the past these two requirements have always been treated separately, with the consequent provision of two generators, and therefore additional "head resistance."

The generator employed will be driven by a newly designed, automatic, constant-speed propeller which will maintain the voltage of the machine constant, under varying conditions of load, over an air speed range of approximately 60 to 130 miles per hour. Moreover, in the unlikely event of a forced landing being necessary, the same generator can be used to supply emergency power to the transmitter either by the use of the battery normally used for lighting, or, alternatively, if it is desired to work for long periods, by means of a special coupling arrangement to the small petrol engine used for starting the main engines. Thus, even if a machine were forced to land in the desert country which is to be found along almost the entire route, it would be an easy matter to establish wireless communication with the nearest ground station and obtain any required assistance.

The AD 6 set, fig. 2, is arranged for telephony or telegraphy up to ranges of 300-400 miles, and since a chain of Marconi aerodrome ground stations is being established by the Air Ministry and the various Governments concerned at frequent intervals throughout the route, the machines will never be out of calling distance of a wireless station.

The Marconi DEP 215 Valve.

We have received a sample of the first Marconi valve to be issued under the new style of nomenclature. As the letters imply, it is a dull-emitter power valve, and the figures give its filament voltage as 2 volts, and current consumption as 0.15 ampere. The filament wattage is therefore less than one-third of that taken by the DE6, and the new valve is as economical as anything on the market; it should be pointed out that it contains two parallel straight filaments. While the amplification factor is 6.25, as compared with 5.5 for the DE6, the impedance is only 6,250 ohms, as against the latter's 10,000, so that the new valve is a great advance in every respect. With 120 volts on the plate and 9 volts on the grid (negative), the emission is 4.8 mA, as against 4.2 for the DE6, while the total emission is also higher at about 18 mA. The DEP215 can be used to replace the DE6 in any Marconi or Sterling receiver, and it will give slightly more volume with a rounder tone,

Fig. 3.—The Marconi Two-filament Valve.

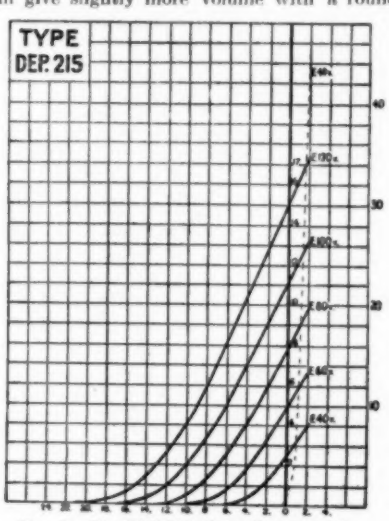


Fig. 4.—The DEP 215 Valve Characteristics.

owing to its greater efficiency. The valve is illustrated in fig. 3, and its characteristic curves in fig. 4; the sample sent us has functioned very well in a simple receiving set.

The "Silite" Electrolytic Rectifier.

The a.c. rectifier known as the "Silite" battery charger, which employs a "metallic-glass" electrode, is an American invention. Mr. C. E. Ogden, of Cincinnati, found that a com-

pound consisting chiefly of common sand possesses the necessary rectifying properties. The silicon is melted in furnaces with an admixture of suitable metals, the molten mass being cast in moulds to produce electrodes of the desired section. The electrodes, when cold, have a crystal metallic structure, and owing to the inexpensive nature of the basic ingredients, can be made of large section, so that a lower cell resistance is obtained, thus resulting in a higher charging efficiency and lower operating temperature of the electrolyte. "Silite" is impervious to attack by acid, or any of the usual impurities, and the electrodes are therefore permanent. The British sale and manufacturing rights relating to the device have been secured by the Carpax Company, Limited, which is marketing the charger in two sizes, the larger giving a charging rate of 2½ amps. and the smaller having a "trickle" output of 0.6 to 0.75 amp. Both types are silent in operation and by the use of automatic regulating transformers the correct charging rate is maintained independently of the capacity or state of charge of the battery. The "trickle" charger may be used while a receiving set is in operation and its addition to an existing accumulator forms an effective method of obtaining valve-filament current from a.c. mains.

A "Geeko" Accumulator.

The General Electric Co., Ltd., has just put on the market a new type of high-voltage accumulator for use in wireless reception. It is made up in a 20-volt unit and cabinets, fitted with three sockets and plugs, can be supplied to accommodate coupled units, each of which is supplied in a specially designed crate, and has a capacity of 2,500 milliampere-hours at 15 milliamperes discharge rate. The containers are of glass and lead elements are used throughout, the separators being of an improved type. Patent tappings are provided at every 2 volts, and filling is made easy by glass tubing embedded in the crown of each cell.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. *No letter can be published unless we have the writer's name and address in our possession.*

Overhead Transmission Lines.

Mr. W. E. Poole, in a letter to you dated November 20th and published in your November 26th issue, points out that the application of "Herringbone" cross-arms to an "A" pole will result in the possibility of that "A" pole being used on longer spans while still maintaining the same ground clearance at the centre of the span. I had not had the advantage of reading his article on conductor spacing when my own was written, though indeed conductor spacing has but a very small bearing on the subject matter of the method of economic span length determination outlined. I do not find myself in complete agreement with Mr. Poole's initial arguments, however. It may be that my experience of overhead transmission lines has been obtained in an area where, in spite of ground subsidences, conductor tensions are maintained equal with consequently little tendency to swing out of synchronism. Experience would appear to indicate, however, that the dangers of accidental contact at the centre of the span arising out of having the conductors supported at the same level can scarcely be as great as Mr. Poole suggests, and that further factors should conceivably be considered, in particular, on long spans. There are in Wales several long spans, notably one of 2,800 feet, on which the sag is of the order of hundreds of feet, whilst the length of the horizontal crossarm does not exceed tens of feet. These are in quite successful operation. My own experience includes the following:—

Span length. Ft.	Sag Ft.	Conductor Material. Ft.	Distance apart of insulators on horizontal cross arm. Ft.
1,000	40	0.2 sq. in. Ph. Br.	16
907	70	0.1 Cu.	16
750	45	0.1 Cu.	14
660	44	0.05 Cu.	20

It is not difficult to obtain even more striking figures from tabulated data of American and Continental installations.

It would appear that in a wind conductors attain an almost steady deflection, and if oscillation does occur it takes place about an axis displaced from the vertical. Two reasons I would suggest for this, namely, that the time of oscillation of the conductor about its points of support is long compared with the period of the gusts of wind, and that air exerts a considerable damping effect on the swinging of the conductors.

This much may be conceded, however, that the method of determining conductor spacings described by Mr. Poole would appear to eliminate all possible danger of accidental contacts. The method normally adopted, unless excessive spacings are used, involves some risk; the risk so introduced is not easily ascertainable, but, as experience shows, may be negligible.

This brings us to "R.M.F.'s" letter. Six feet horizontal spacing suffices for a 475-foot span of 0.1 sq. in. conductor. This spacing has not been decided by any particularly scientific method, but rather by the methods Mr. Poole criticises on page 608. Satisfactory experience would seem to indicate, however, that the risks involved are very small, since there is no evidence of any accidental contact due to conductors being blown together by wind on some hundreds of miles of overhead lines where the spacings have been decided in this somewhat arbitrary manner.

As indicated in the writer's article in the issue of November 12th, in all probability 0.05-sq. in. copper conductors would not be erected on this type of pole. Conductors of this section in other materials are, however, worthy of consideration, and using stronger material, *e.g.*, steel cable or copper-alloy cable, the sags will be of the same order as for the 0.1-sq. in. copper conductor, and a similar crossarm will be suitable.

It is perhaps unnecessary to mention that care is necessary to ascertain that the strength of details such as binders, insulator pins, &c., is up to the increased duty brought about by these increased span lengths.

E. A. Logan.

Newcastle-on-Tyne, *November 29th*, 1926.

Power Supply for Wireless Sets.

I have read with interest the letter of Mr. H. Hewlett in your issue of December 3rd.

He points out quite truly that in the hands of unskilled people h.p. accumulators frequently depreciate at a rapid rate. Mr. Hewlett, however, makes the assumption that the user is left to undertake the charging of his accumulators as best he may. In such cases the accumulators often have to be carried by car or other vehicle to the charging station, and this in itself is very bad for accumulators.

If, however, proper arrangements are made for charging the accumulators at home, all these objections fall to the ground. We have always realised the importance of proper charging, and whenever we suggest to possible users that they should install h.p. accumulators, we always make arrangements so that these can be placed on charge simply by moving a switch. For a.c. supplies we have developed a rectifying charger using a special valve of our own manufacture, and for d.c. supplies we offer a change-over switch which serves the same purpose. All that the unskilled user has to do is to switch over from "set to charger" about once a fortnight, after finishing with the set for the night, and leave the switch in this position until the set is wanted the next day. In addition, he is asked to examine the battery once every few months, and, if necessary, to add water. Under conditions of use such as these we find the life of good h.p. accumulators to be perfectly satisfactory.

For your own information I enclose herewith a pamphlet entitled "Power for your Radio Set," which will show you that we have devoted serious attention to the whole of this question.

P. K. Turner,
Research Department, Burndept Wireless, Ltd.

Blackheath, *December 4th*, 1926.

I certainly agree with Mr. H. Hewlett's opinion, but the whole question is wrapped up in one's personal requirements.

For casual use I think the large-sized dry batteries should be seriously considered, as I have found that with care they will last me 12 months with a current discharge when at work of, say, 5 mA; therefore, in the light of my experience, Mr. A. E. Irwin's figure is high.

For continuous use with heavy currents of, say, 15 mA, a supply obtained from the mains is the most satisfactory.

I have used large wet Leclanché cells for the filaments of 3-volt 60-mA valves without much trouble, but I have not tried wet cells for h.p.

From Mr. Hewlett's experience I should like to make the experiment, but before doing so I should esteem it a favour if Mr. Hewlett could let me know the maximum safe current in mA he would advise for an average life for the cells he has been using.

R. Kirlew.

London, *December 4th*, 1926.

The Cost of Living in Shanghai.

I shall be glad if any of your readers can give me any information relating to living in Shanghai, with particular reference to the cost of living and the standing expenses to be met in maintaining a bachelor's establishment.

I shall also be glad of any hints as to the kit necessary which could advisably be purchased in this country.

November 29th, 1926. **Canniscot.**

The Rent Meter.

I am much obliged to Mr. P. Wardle for drawing attention to the confusion which would result in a meter-testing department if "rent meters" were put into service and the fixed rotation were to vary otherwise than with the capacity of the meter. I agree with practically everything he says.

Considerable difficulty has been experienced in arriving at a basis for determining what the fixed charges should be in a given installation. The ratable value has only been adopted

by certain undertakings because it seemed a convenient way of avoiding disputes and arguments. Whilst it is not an ideal method, there is no reason why it should not be the basis adopted by an undertaking using "rent meters," provided the fixed charge goes up in regular steps, *i.e.*, the ratable value up to, say, £10 would be the lowest grade, and the next step would be, say, between £10 and £20, and so on. In practice this would mean that the various capacities of the rent meter would each apply to a given grade of ratable value, and as far as the meter testing department is concerned, each size of meter would have a definite no-load speed.

It may be argued that with this method anomalies may occur, in that certain consumers paying low rates may want a larger meter than others paying high rates. This only shows that the ratable value is a bad criterion on which to base a fixed charge. Even so, however, it would have to be an extremely glaring case to put the rent meter out of court, on account of the fact that the rent meter is just as accurate at 1 per cent. of full load as it is at full load, and rent meters are capable of carrying double full load accurately and without injury. There is, therefore, no need to make rent meters for capacities as low as 2½, 5 or 10 amps.

If the lowest size is a 20-amp. meter, and this is used for the lowest ratable value, and if the next size is, say, 25 amps. for the next step of ratable value, and so on, it is unlikely that any difficulties will occur through variations in demand by consumers paying the same amount in rates, as in practically every case the meter will be far larger than is necessary.

To appreciate that this is no disadvantage it is necessary to remember that, apart from the question of cost, ordinary meters are kept down in capacity so that they are not too inaccurate on low loads. No one would think of installing, say, a 20-amp. ordinary meter for a consumer whose needs would be met by a 2½-amp. meter, because it is well known that there would be no sort of accuracy on low loads. With the rent meter, however, it is perfectly safe to install a 20-amp. meter for a 2½ amp. consumer, as more or less 100 per cent. accuracy commences at no load

It is an advantage to have a meter of ample size installed in the first instance, particularly when a domestic load is being built up and consumers are encouraged to add current-consuming devices.

As to what would happen if a rent meter stopped halfway through the quarter, there would be no more difficulty in estimating the amount to charge than there is with an ordinary meter. The supplier obviously knows what the fixed part of the tariff should be for a quarter, as this is in any case constant. There only remains the question of the actual units consumed, and this would have to be estimated precisely on the same lines as with an ordinary meter.

R. Amberton.

London, *November 29th*, 1926.

Variable-speed Three-phase Motors.

In your issue of 26th instant, "Variable Speed" requests suggestions regarding the best method of driving a fan for compressing gases. The fan is to run at anything between 800 and 2,000 r.p.m., and the power required at maximum speed is 40 h.p.

Provided the gases are not likely to be detrimental to the commutator, brush gear, and windings, a 3-phase, variable-speed, a.c. commutator motor with brush-shifting gear, could be used for this purpose. Where the gases are likely to affect the commutator and windings, it is generally possible to supply clean and pure air to the motor by means of pipes.

The British Thomson-Houston Co., Ltd., has developed a suitable variable-speed a.c. commutator motor; it has manufactured a large number of these motors and applied them successfully to almost every type of variable-speed drive, including fans for boiler houses, gas works, and chemical works.

With this motor any speed throughout the range specified can be obtained, and it is particularly suitable for applications requiring very fine speed regulation. The efficiency is high, as there are no losses in regulating resistances, and a good power factor is obtained, especially at the higher speeds, where the power factor is practically unity. Motors have been built in this country for powers ranging from 3 to 300 h.p. and have proved thoroughly reliable.

H. Jack.

Rugby, *November 30th*, 1926.

Referring to "Variable-speed's" letter of 26th ult., I am tempted to ask: What is the matter with simple rheostatic control of a three-phase slip-ring motor? It is cheap, simple, but inefficient; however, it would accomplish "Variable-speed's" object. If the Editors will permit a little gratuitous advertising, I propose, without being interested other than theoretically, to supplement the correspondence published in the ELECTRICAL REVIEW of December 3rd, 1926. I was disgusted, but not surprised to read that the fan makers depreciate the brush-shifting type of motor as manufactured with shunt characteristics in Sweden by the A.S.E.A. Company, known here as the Swedish General Electric, Ltd. The job could also be done perfectly by adopting a Scherbius combination as exploited, I believe, by Messrs. Brown, Boveri and Co. To my mind the job should be done electrically. The mechanical solution is, however, quite easy. The expanding pulley principle or the reverse cone pulley and endless pilot friction belt are both efficacious. The former is known as the "Reeves" type, while the latter is the "Evans" type, both being manufactured, I believe, by Messrs. Crofts, Ltd., of Bradford. A few years back I applied a Reeves equipment to a 15-h.p. single-phase problem, with quite satisfactory results, but the losses are high due to friction.

Finally, possibly the P.I.V. people of Westminster will have something to say.

W. E. Rogers, A.M.I.E.E.

London, *December 4th*, 1926.

The B.E.S.A. Glossary.

A letter from Mr. F. T. Fawcett which appeared in your issue of November 12th, calls for comment. He says: "In view of the fact that he makes it mean 'work,' I am inclined to agree that 'force' is indeed a badly treated word," and further on: "Prof. Howe's suggestion is definitely wrong. Force is not work." Now all this is based on a common fallacy and serves to emphasise my statements. What is miscalled "electromotive force" is not a force at all, nor is "magneto-motive force"; it is very unfortunate that the word "force" was ever introduced into these two terms, but it is now too late to suggest altering them. Hence Mr. Fawcett's dictum that "force is not work" is quite beside the point. Perahps the most accurate definition of electromotive force is: "the capacity for generating electromagnetic energy by the transfer of electricity, the unit being the amount of energy generated by the transfer of unit quantity of electricity." With the latter part of Mr. Fawcett's letter I am in general agreement; I agree with him that it is more correct to say that the e.m.f. is numerically equal to the work, &c., than to say that it is the work, &c.

In your issue of November 19th, Prof. Fortescue asks: "What is the *objective* distinction between 'Field strength' and 'Flux Density'?" I suppose that by these terms Prof. Fortescue refers to what are usually represented by the symbols H and B. The latter is unchanged on passing from the pole shoe into the air-gap, whereas the former undergoes a great change. I presume that it is H which is under the suspicion of having no *objective* existence. Whether so or not, it has a very real *subjective* existence in the minds of most physicists and electrical engineers, and in the pages of text-books.

If an iron ring is magnetised by a certain number of ampere-turns, a very small air-gap will suffice to reduce the magnetic flux to a value corresponding to about half the ampere-turns on the ring without the gap. A half of the total ampere-turns may then be regarded as causing the flux in the iron, and the other half as causing the flux in the air-gap. We may then regard the flux density at any point in the iron as being due to so many ampere-turns per cm. and the flux density at any point in the air-gap as due to a much greater number of ampere-turns per cm. Except for a numerical factor $4\pi/10$, it is this number of ampere-turns per cm. which we regard as the localised cause of the magnetic induction at the point and designate by the symbol H. One may regard H as an abbreviation for $4\pi/10$ times the ampere-turns per cm. which must be allocated to the point considered.

Whether the ampere-turns have lost anything of their objectiveness by their allocation in this way to each unit length of the magnetic path, or by being conceived to act as a localised cause of the magnetisation at the point and called by another name, is a philosophic question into which I am not qualified to enter.

G. W. O. Howe.

Glasgow, *December 4th*, 1926.

P.S.—Anyone who is very interested in this subject should read an article by Wallot in *Elektrotechnische Zeitschrift* of September 2nd, 1926.

A Motor-Generator Snag.

Recently I obtained from a very well-known maker a motor-generator to give 30 amperes at 100 volts. The machine was frequently run at low loads, when the voltage rose to 170 V, although it only gave 100 volts when delivering the rated amperes. The result was that, owing to excessive pressure at low load, the field coils burnt out. I called the makers' attention to this, and they replied with a lofty letter that they had not guaranteed the machine to run at low loads, and it was our fault if the field coils burnt out.

At first sight it would appear absurd to ask for a guarantee that a motor-generator will run at both full load and low load, but this experience proves that this must be specified if the results are to be satisfactory.

I write this letter hoping it may save some other purchaser from having my painful experience.

Motor Generator.

Wiring for Domestic Appliances.

I have not the advantage of knowing Mr. S. A. Curzon, the correspondent writing under the above heading in your issue of November 26th, nor can I guess his occupation, but I feel bound to "cross swords" with him, on account of his views which he expresses in such a definite manner.

It is very galling to have criticism and loose talk so continually levelled against electrical contractors by those having only a nodding acquaintanceship with this branch of the industry.

There are engineers who have devoted the whole of their time as specialists in this class of work, and I maintain that many carry out their varied work with skill equal to that of their brothers specialising in some other—and frequently more congenial—section of the electrical profession.

It is said that "fools rush in where angels fear to tread"; whilst I would not suggest for one moment that critics of the contractors are all fools, I do affirm that with a little more inside experience, much of the tosh spoken and written on installation work and its organisation would be unrecorded.

All contractors are not lunatics; they are able to run their business in as efficient a manner as their critics handle theirs, in spite of the bricks which are so often thrown at them. They have done and are doing a big share in educating the public in electrical matters, and are entitled to a fair share of credit for the present position to which electricity supply has attained, but what is their reward?

Municipal engineers (without the personal and long inside experience of the contractor in these matters), with capital supplied by ratepayers, want to enter into competition with the contractor—who is also usually a ratepayer—the man who has helped nurse the (electricity supply) baby into maturity—by selling apparatus themselves, usually being willing to leave the wiring "crumbs" to the contractor.

Your correspondent, I am glad to note, does not expect that the contractor shall "visualise what some future tenant will do with an installation," but how a fuse on portable apparatus will protect the connecting flex conductor—the most constant source of trouble—I do not appreciate, neither can I refrain from wondering whether his twenty years of experience has been in some other sphere if it leads him to the conclusion as to "gadgets, sold and bought" expressed by him.

I note also that the personal view of Mr. Curzon is that the contractor "never has shown initiative," and that any other opinion is "bosh"; but perhaps when he has passed his twenty-first year of experience, he will know better. At any rate I hope so, and sign myself

Electrical Contractor
(*Also of Croydon*).

Croydon, *November 29th*, 1926.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from December 1st. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Electrice. No. 470,921. Class 6. Electrical refrigerating machines.—J. Mercadente, 120, Broadway, New York. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Standard Telephones, Cables (lettering and design). No. 472,154. Class 8. Electric cables and telephonic instruments.—Standard Telephones and Cables, Ltd.

Undophone. No. 470,200. Class 8. Scientific and philosophical instruments and apparatus for useful purposes.—H. Kuchenmeister, 1 Furtherstrasse, Berlin. (Sefton-Jones, O'Dell & Stephens, 285, High Holborn, W.C.1.)

Aceta. No. 472,279. Class 13. Electric junction boxes of ordinary metal.—Finnieston Engineering Co., Ltd., 42, Somerville Street, Glasgow.

Mat (lettering and design). No. 473,279. Class 13. Accumulator plates.—Compagnie Générale l'Electricité, 54, Rue de la Boetie, Paris. (Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

Pelican (lettering and design). No. 473,541. Class 13. Navigation lamps, electric and oil.—M. P. Galloway, Ltd., 8, Timber Bush, Leith.

Published Specifications.

Compiled expressly for this journal by Patent Agents
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

10,554. "Anti-phonic mount for thermionic valves." J. G. Wright and Wright & Weaire, Ltd. January 22nd, 1926. (260,773.)

17,732. "Alloys suitable for loading telephone and telegraph conductors." W. S. Smith and H. J. Garnett. July 10th, 1925. (261,060.)

17,754. "Track-signalling circuits and apparatus for railways." Siemens Bros. & Co., Ltd., and J. Boot. July 10th, 1925. (261,061.)

19,091. "Manufacture of electrical condensers." Paralite Compositions Co., Ltd., and W. A. M. Valon. July 27th, 1925. (Patent of addition not granted.) (261,064.)

19,632. "Process and apparatus for electro-deposition." International Copperclad Co. August 5th, 1924. (248,230.)

19,872. "Electrical contacts especially applicable for fuse contacts." C. W. Cox, C. E. C. Shawfield, and E. E. Bartlett. August 7th, 1925. (261,066.)

19,873. "Electrical fuses." C. W. Cox, C. E. C. Shawfield, and E. E. Bartlett. August 7th, 1926. (Cognate application 3,432/26.) (261,067.)

19,902. "Electric relays." A. D. Cardwell. August 15th, 1924. (238,540.)

19,925. "Transmitting means for recording or signalling systems." A. Bursill, B. Dunglinson, and H. W. Healy. August 7th, 1925. (261,070.)

20,019. "Electric cables." Callender's Cable and Construction Co., Ltd., and S. J. Bryce. August 10th, 1925. (261,074.)

20,035. "Telephone systems." Standard Telephones and Cables, Ltd., G. Deakin, and L. Polinkowsky. August 10th, 1925. (261,075.)

20,057. "Telephone systems." Standard Telephones and Cables, Ltd., G. Deakin, and L. Polinkowsky. August 10th, 1925. (261,076.)

20,067. "Sound apparatus for producing and receiving sound waves." Signal Ges. August 11th, 1924. (238,250.)

20,090. "Electric switchgear." A. Reyrolle & Co., Ltd., F. Coates, and J. Mirrey. August 10th, 1925. (261,078.)

20,118. "Electrolytic apparatus." A. E. Knowles. August 11th, 1925. (261,080.)

20,170. "Crystal detectors for wireless signalling." British Thomson-Houston Co., Ltd., R. C. Clinker, and T. H. Kinman. August 11th, 1925. (261,081.)

20,185. "Thermionic amplifiers." Telegraph Construction and Maintenance Co., Ltd., and H. C. Redgrave. August 11th, 1925. (261,082.)

20,217. "Telephone systems." Siemens & Halske Akt. Ges. August 18th, 1924. (238,549.)

20,282. "Method and means for effecting electrical amplification, more especially for use in radio communication." Radio Patents Corporation and W. Dubilier. August 12th, 1925. (261,088.)

20,283. "Sound reproduction, recording, and like devices." D. C. A. Hulstrom. August 12th, 1925. (Cognate application 24,889/25.) (261,089.)

20,375. "Construction of a support for inductance coils." A. E. White (T. H. Brennan). August 13th, 1925. (261,097.)

20,469. "Automatic telephone systems." Standard Telephones and Cables, Ltd. (B. A. Turkhud). August 14th, 1925. (261,103.)

20,470. "Automatic and semi-automatic telephony." Standard Telephones and Cables, Ltd., R. A. Moir, and G. C. Hartley. August 14th, 1925. (Cognate application 5,201/26.) (261,104.)

20,530. "Lightning or surge arresters." Electrical Improvements, Ltd., and L. C. Grant. August 15th, 1925. (261,106.)

20,539. "Telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky). August 15th, 1925. (261,109.)

20,556. "Electric time switches." P. Krout. August 15th, 1925. (261,111.)

20,766. "Electric vibrators." Electric Improvements, Ltd., and L. C. Grant. August 19th, 1925. (261,115.)

20,796. "Sensitive electrical regulating or indicating devices." C. E. Foster. August 19th, 1925. (261,116.)

21,368. "Ignition apparatus for automobiles." A. V. Pellet. August 26th, 1925. (261,121.)

21,409. "Carriers for inductance coils or the like." Igranic Electric Co., Ltd., and A. H. Curtis. August 26th, 1925. (261,122.)

21,482. "Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., and W. G. Patterson. August 27th, 1925. (261,128.)

21,614. "Electrical interrupters." F. Fearn. August 28th, 1925. (261,131.)

21,782. "Automatic telegraph receiving apparatus." Western Union Telegraph Co. July 21st, 1925. (255,801.)

22,154. "Current conductors for high-frequency purposes." Telefunken Ges. fur Drahtlose Telegraphie. September 5th, 1924. (239,534.)

22,515. "Recording and reproduction of sound." A. Stevens. September 9th, 1925. (261,136.)

22,759. "Modulation of high-frequency currents for signalling." Telefunken Ges. fur Drahtlose Telegraphie. September 12th, 1924. (Addition to 239,534.) (239,872.)

22,761. "High-frequency current conductors." Telefunken Ges. fur Drahtlose Telegraphie. September 12th, 1924. (Addition to 239,534.) (239,874.)

23,131. "Methods of signalling employing frequency-multiplying transformers." Telefunken Ges. fur Drahtlose Telegraphie. September 16th, 1924. (Addition to 239,534, as modified by 239,872.) (240,162.)

23,524. "Electromechanical valve-operating means for internal-combustion engines." L. N. Bland. September 21st, 1925. (261,141.)

23,953. "Control of electric motors." British Thomson-Houston Co., Ltd., R. D. Given, and J. V. Peacock. September 25th, 1925. (261,144.)

24,153. "Variable resistance devices especially for use in radio apparatus." A. H. Curtis, G. Holdway, and Igranic Electric Co., Ltd. September 28th, 1925. (261,148.)

24,338. "Sound reproducing apparatus." P. S. O'Donnell. September 30th, 1925. (Cognate application 4,176//26, a divided application on 256,677.) (261,154.)

24,861. "Wireless telephony and telegraphy." E. A. Patterson. October 6th, 1925. (261,155.)

25,273. "Axle for tramway, railway, and other vehicles." P. Algrain. October 9th, 1925. (261,157.)

26,024. "Electrolytic apparatus." A. E. Knowles. October 19th, 1925. (261,164.)

27,003. "Electric resistance furnaces for bright annealing." Siemens-Schuckertwerke Ges. December 15th, 1924. (244,425.)

27,095. "Modulation of high frequency currents." Telefunken Ges. fur Drahtlose Telegraphie. October 20th, 1924. (Addition to 239,534, as modified by 239,872.) (242,295.)

27,114. "Audion and high-frequency amplifying tube." Dr. S. Loewe. November 13th, 1924. (242,965.)

27,823. "Reel or drum for electrical conductors." Callender's Cable and Construction Co., Ltd., and A. Stevenson. November 5th, 1925. (261,177.)

28,115. "Motor vehicle headlights and the like." E. A. Smeeton. November 9th, 1925. (261,178.)

28,841. "Wireless receiving apparatus." A. H. Midgley. November 16th, 1925. (261,183.)

29,355. "Reels or drums for electric conductors." Callender's Cable and Construction Co., Ltd., and W. Hakesley. November 20th, 1925. (261,189.)

29,720. "Electric resistance control devices." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). November 24th, 1925. (261,191.)

30,256. "Radio-vision and telekinematography." E. Belin. November 30th, 1925. (261,195.)

1926.

914. "Electric water-heaters or geysers and heating elements therefor." J. H. Ewart. January 12th, 1926. (261,215.)

3,385. "Electric couplings for coils, valves, and the like of wireless apparatus." M. Liebermann. February 20th, 1925. (247,937.)

4,803. "Electric space charge devices." Westinghouse Electric and Manufacturing Co. February 26th, 1925. (248,305.)

5,985. "Electromagnetic acoustic apparatus." British Thomson-Houston Co., Ltd. (Compagnie Française pour l'Exploitation des Procédés Thomson-Houston). March 3rd, 1926. (261,231.)

6,311. "Electromagnets or solenoids." L. N. Bland. September 21st, 1925. (Divided application on 261,141.) (261,234.)

6,736. "Electric thermal responsive devices." British Thomson-Houston Co., Ltd. March 11th, 1925. (249,130.)

6,823. "System for supplying electricity to consumers situated at a distance from each other." Siemens-Schuckertwerke Ges. February 26th, 1926. (261,239.)

6,919. "X-ray apparatus." Siemens & Halske Akt. Ges. March 14th, 1925. (249,146.)

7,262. "Electrically or otherwise illuminated reading glass." E. Schaaf. March 20th, 1925. (249,521.)

9,411. "Sound-reproducing machines." H. G. C. Fairweather (E. G. Barker and G. A. Rawson). April 9th, 1926. (261,254.)

9,969. "Automatically-reclosing circuit-breaker systems for continuous-current traction lines." R. Alliaume. May 14th, 1925. (252,134.)

10,385. "Electric circuit controllers." British Thomson-Houston Co., Ltd. April 20th, 1925. (250,986.)

10,943. "Inductance coils and insulators therefor." British Thomson-Houston Co., Ltd. April 25th, 1925. (251,300.)

11,214. "Electrical clockwork." E. Butticaz. April 28th, 1925. (251,639.)

12,177. "Tell-tale or indicator for use in connection with electric lighting." A. E. Mason. May 11th, 1926. (261,277.)

12,810. "Electrical deposition of organic materials." Kodak, Ltd. June 8th, 1925. (263,091.)

14,847. "Electric condensers." International General Electric Co., Inc. June 13th, 1925. (253,552.)

15,059. "X-ray screens." H. S. Sawford. July 24th, 1925. (Addition to 228,533.) (255,831.)

16,089. "Incandescent electric lamps." J. Buser-Bollier and J. Buser. June 20th, 1925. (254,335.)

16,099. "Table and like lamps." A. Ramsay. June 20th, 1926. (261,303.)

17,448. "Supporting device for telephone apparatus." Brevex Soc. Anon. July 23rd, 1925. (255,854.)

18,117. "Gripping devices for electric welding machines." International General Electric Co. Inc. July 20th, 1925. (255,499.)

18,513. "Apparatus for electric welding." British Thomson-Houston Co., Ltd. August 4th, 1925. (256,599.)

19,714. "Thermionic valve circuits." Hazeltine Corporation. February 27th, 1925. (Divided application on 248,311.) (256,649.)